EDISON ELECTRIC INSTITUTE BULLETIN

Courtesy, The Detroit Edison Co.

VOLUME II FEBRUARY 1934 NUMBER 2

STATISTICAL DATA OF THE ELECTRIC LIGHT AND POWER INDUSTRY

Compiled Monthly by the Edison Electric Institute—Covers 100% of the Industry

DURING THE MONTH OF DECEMBER

	1933	1932	%
Kilowatt-hours Generated* (net)			
By fuel	4,433,690,000	4,070,419,000	+ 8.9
By water power	2,485,360,000	2,516,986,000	− 1.3
Total kilowatt-hours generated	6,919,050,000	6,587,405,000	+ 5.0
Additions to Supply			
Energy purchased from other sources	195,387,000	204,429,000	− 4.4
Net International imports	69,404,000	29,751,000	+133.3
Total	264,791,000	234,180,000	+13.1
Deductions from Supply			
Energy used in electric railway depts.	65,028,000	78,844,000	−17.5
Energy used in electric and other depts.	109,649,000	104,317,000	+ 5.1
Total	174,677,000	183,161,000	− 4.6
Total Energy for Distribution	**7,009,164,000**	**6,638,424,000**	**+ 5.6**
Energy lost in transmission, distribution, etc.	1,318,438,000	1,293,526,000	+ 1.9
Kilowatt-hours Sold to Ultimate Consumers	**5,690,726,000**	**5,344,898,000**	**+ 6.5**
Sales to Ultimate Consumers (kw-hrs)			
Domestic Service	1,147,047,000	1,130,829,000	+ 1.4
Commercial—Small Light and Power (Retail)	1,137,914,000	1,125,384,000	+ 1.1
Commercial—Large Light and Power (Wholesale)	2,661,895,000	2,382,620,000	+11.7
Municipal Street Lighting	212,393,000	217,491,000	− 2.3
Railroads—Street and Interurban	387,266,000	382,415,000	+ 1.3
Railroads—Electrified Steam	63,127,000	50,227,000	+25.7
Municipal and Miscellaneous	81,084,000	55,932,000	+45.0
Total Sales to Ultimate Consumers	5,690,726,000	5,344,898,000	+ 6.5
Total Revenue from Ultimate Consumers	$156,127,100	$157,561,400	− 0.9

DURING TWELVE MONTHS ENDING DECEMBER 31st

Kilowatt-hours Generated* (net)			
By fuel	47,426,520,000	45,778,383,000	+ 3.6
By water power	31,591,146,000	31,106,865,000	+ 1.6
Total kilowatt-hours generated	79,017,666,000	76,885,248,000	+ 2.8
Purchased energy (net)	2,894,258,000	2,619,465,000	+10.5
Energy used in electric railway and other departments	1,902,423,000	2,062,601,000	− 7.8
Total energy for distribution	**80,009,501,000**	**77,442,112,000**	**+ 3.3**
Energy lost in transmission, distribution, etc.	14,255,893,000	13,678,088,000	+ 4.2
Kilowatt-hours sold to ultimate consumers	**65,753,608,000**	**63,764,024,000**	**+ 3.1**
Total revenue from ultimate consumers	$1,773,415,600	$1,832,595,900	− 3.2
Important Factors			
Per cent of energy generated by water power	40.0%	40.5%	
Average pounds of coal per kilowatt-hour	1.45#	1.47#	
Domestic Service (residential use)			
Average annual consumption per customer (kw-hr)	604	601	+ 0.5
Average revenue per kw-hr (cents)	5.49¢	5.58¢	− 1.6
Average monthly bill per domestic customer	$2.76	$2.79	− 1.1

BASIC INFORMATION AS OF DECEMBER 31st

Generating Capacity (kw)—Steam	24,042,200	24,215,200	
—Water power	8,999,200	8,918,700	
—Internal Combustion	453,000	458,600	
Total generating capacity in kilowatts	33,494,400	33,592,500	
Number of Customers			
Farms in Eastern Area (Included with Domestic)	(506,637)	(500,782)	
Farms in Western Area (Included with Com'l—Large)	(204,005)	(204,293)	
Domestic service	20,006,129	19,849,963	
Commercial—Small Light and Power	3,697,324	3,687,636	
Commercial—Large Light and Power	525,625	544,689	
All other ultimate consumers	66,437	67,012	
Total Ultimate Consumers	24,295,515	24,149,300	

*By courtesy of the U. S. Geological Survey with deductions for certain plants not considered Electric Light and Power Enterprises.

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EDISON ELECTRIC INSTITUTE BULLETIN

Volume II FEBRUARY, 1934 No. 2

"ELECTRIC TABLE SERVICE SAVES"

And We Are Going to Tell the World About It

By C. E. GREENWOOD
Commercial Director, Edison Electric Institute

The urge to rapidly increase energy output for residence consumption has influenced the utility companies over the past three years to center attention in the major load builders. The success of sales of electric refrigerators has been widely publicized and the record speaks for itself. Final count of sales last year, which appears in another page of this issue of the BULLETIN is approximately 1,065,105 units.

On the other hand the sales curve on electric ranges has turned rapidly downward. From a peak of 180,000 in 1930, sales dropped to 115,000 in 1931; 60,000 in 1932, and approximately 57,000 in 1933. The National Cookery Council is tackling this sector of the sales development program.

Electric water heating has been growing in favor for promotional attention but sales have been trailing.

Just as our lighting load was taken for granted for several years, some of the smaller household devices of 1000 watts capacity and under have been left to the mercy of the merchants in other lines. In recent years many utilities have given up the sale of small appliances, and numerous companies gave up advertising. The merchants have used small advertising space for selling electrical lines as compared with that used by the utilities, and for obvious reasons.

The apparent neglect of small devices has resulted because of a confidence on the part of the utility that the department, hardware, furniture and electrical stores have had their interest aroused in these lines, and that they would vigorously promote them as profitable merchandising items. Outlets other than utility were responsible for about 85 per cent of the total sales of smaller appliances in 1932. Perhaps the percentage was greater for 1933. During the past three years there has been a steady decline in the sales of popular tableware such as toasters, percolaters, waffle irons, small cookers, grills, hot plates, mixers, and even clocks. The home laundry devices came into their own again, last year the sale of washing machines being the highest in three years. The sale of ironing machines increased 30 per cent over the previous year. Dealers either neglected the electric table cookery group, or the economic barrier was too difficult to break down without greater support from the utility. Whatever the cause, something should be done about it.

The first stage of the National Lighting Program closes in March and will be resumed again in September. The chairman of the Residential Sales Subcommittee, Mr. Davis M. DeBard, of Stone & Webster Service Corporation, has presented a proposal from that committee that a national program of stimulation, built up along similar lines to the Lighting Program, should be undertaken during the six months starting Mar. 1. The proposal has been accepted by the Sales Committee of the Institute, and Chairman George E. Whitwell has announced a national program on Electric Table Cookery jointly with the Heating Device Division of the National Electrical Manufacturers Association, and other leading appliance manufacturers.

Mr. Whitwell has appointed a special committee to carry through the program, consisting of D. M. DeBard, Chairman, C. E. Swartzbaugh, President, Swartzbaugh Manufacturing Company and Chairman, Heating Device Division of NEMA, R. W. Turnbull, General Electric Company, F. R. Kohnstamm, Westinghouse Electric &

Sales Conference
March 14-15

Looking backward to the Convention of the Edison Electric Institute of 1933 those attending the Convention will recall an intensely interesting Commercial Session. But there were only three hours to present important market developments and activities. It will be gratifying news to commercial men everywhere to learn that the sales Committee will sponsor a two-day Commercial Conference at the Edgewater Beach Hotel on Mar. 14 and 15 where leading load. building problems will be presented and discussed.

Sessions will be open to all utility representatives, and likewise manufacturers, distributors and dealers interested in the business of the electric utility.

The hotel management has quoted winter Convention rates, and it is interesting to note that the extension of Lake Shore Drive has been completed to a point within one block of the hotel and transportation from the Loop is now afforded in about 15 min. Taxicab rates have been cut almost 50 per cent.

Commercial Executives should plan now to attend. Bring along men in pivotal positions, men who are responsible for getting results.

Reservations can be made by writing direct to the Edgewater Beach Hotel.

Manufacturing Company, and C. E. Greenwood, Edison Electric Institute.

It is again emphasized that this will not be a "campaign" but a cooperative program of stimulation for sales and advertising activity locally on the complete line of household devices which are so serviceable in the kitchen and dining room. Women are far from acquainted with the conveniences and the help of the modern lines of electric tableware. Utilities are expected to take leadership locally to correct the situation, and join in a cooperative endeavor with manufacturers, wholesalers, utilities and all the trades selling appliances.

The slogan adopted by the Committee is ELECTRIC TABLE SERVICE SAVES which is expressive, and will make an effective advertising theme. A news medium will be widely circulated each month under the caption *Table Cookery Topics* and will carry news of the plans of the Committee, and news items on sales developments.

Someone will ask, "Why an expression of national interest in the small appliance line?" One answer is that many thousands of homes should know, and can take advantage of the conveniences of electricity as a fuel for cooking and for preparation of food. They may not be able to afford, or they may not be in a position to use an electric range. Should such a market be further overlooked?

Manufacturers have improved their lines in the past few years, made more serviceable devices, made them more useful with automatic attachments, and more to be desired because of their artistic appearance. Such merchandise should be going into the homes of our electric consumers in many times greater volume than ever before. It can be made profitable merchandise for the trades.

The advantage to the utility can be measured by the Commercial Manager if he makes a careful study of his domestic consumers. How many live in unwired apartments and cannot have the advantage of an electric range? How many live in rented homes and do not wish to make an investment in wiring in the owner's premises? This is a handicap to range promotion if the utility does not have a rental plan. How many family incomes are so low in your community, that spending margins will not permit of an investment in an electric range, and yet a small investment in a casserole, grill, toaster, or some other useful cooking device, and a mixer to encourage easy preparation of food, will contribute a partial cooking service? And for those Commercial Managers who have cooking rates, and sell electric ranges, will not the promotion of some of the most useful of these devices help to sell the broad idea of "electricity as a fuel for cooking?"

Let those readers who are in the utility field bear in mind that the aggregate kilowatt-hours used in the smaller appliances that have popular appeal in the home, and which serve so well that the homemaker gives them normal use, will help in the recovery of much needed revenue.

All dealers other than the utility companies are primarily interested in the *sale* of these devices. The utility is primarily interested in their *use*. This suggests an obligation of all Home Service Departments in the utility. There are some table cookery devices that need demonstration almost as completely as the electric range. Is it not our job to make electrical consumers know what these appliances will do for them, and encourage their sale? Better an electric appliance remain in the store display, than out of service on the cupboard shelf of the home.

We start with enthusiasm and optimism. Results will depend on the wholehearted support of all sales outlets, and utility leadership in local coordination.

BETTER LIGHTING PROGRAM CONTINUES

"We are enclosing Money Order for $5.00 which we would ask you to apply to twelve months' subscription to your publication entitled *Lighting News*, at the same time sending us if possible the early issues so that we may have a complete file. Should there be any surplus out of the $5.00 forwarded, would you kindly apply it to a supply of BETTER LIGHT, BETTER SIGHT lapel buttons?

"We have adopted the slogan BETTER LIGHT, BETTER SIGHT, and it appears on all our stationery and in large silhouetted letters on the walls of our very modern Show Rooms."

This quotation from a correspondent is not from an enthusiastic utility or lighting equipment manufacturer in the United States, but a manufacturer of lighting equipment in Australia, indicating that the influence of the BETTER LIGHT, BETTER SIGHT Program has gone far beyond the borders of the United States. Canadian companies tied in much earlier. The appeal is as broad as it is vigorous.

At the last meeting of the Lighting Program Committee called by Chairman M. E. Skinner, new developments were discussed which will add to contributions already made for improvement of lighting. It has been agreed that after the distribution of the March issue of *Lighting News* there will be a cessation of publication until September. However, the National Committee will continue to function and lay its plans for industry improvement.

Mr. George E. Whitwell, Chairman of the Sales Committee, issued a preliminary report on lighting activities indicating that 734 cities of 10,000 population and over had participated in the E.E.I. Program. Out of 985 cities in this class there was 74 per cent participation. Records show that 516 companies operated lamp campaigns; 462 home lighting campaigns, and 596 commercial campaigns.

Lamp campaigns showed an average lamp sale per meter of 1.3, and the estimated wattage per lamp sold was 63.

The best available statistics show a total sale of 350,000 wall brackets, 135,000 attachable fixtures, and 78,000 indirect portable lamps.

Trade papers with an approximate circulation of 864,000 carried stories on the BETTER LIGHT, BETTER SIGHT activity, and eight national magazines with a total circulation of 32,000,000 carried stories built around the better lighting idea. Fifteen hundred newspapers with a total circulation of 25,000,000 commented on the activity.

During the period since November 1, 40 lighting schools have been held with an attendance of 24,000, and 1950 "talks" on lighting were given before an aggregate audience of 59,000 people.

What is considered one of the most important accomplishments was an estimated increase of 453 in lighting personnel, which, though comparatively small in number, represents approximately a 75 per cent increase over last year.

We cannot afford not to have the National Lighting Program a sustained effort.

COUNTRY-WIDE SALES OF ELECTRIC REFRIGERATORS IN 1933 REACHED TOTAL OF 1,065,105 UNITS

Refrigeration Bureau's National Quota Exceeded by Nearly One-Third—Georgia Leads in Quota Realization, New York in Total Sales—Holiday Window Display Contest Winners Announced

Final figures tabulated by the Electric Refrigeration Bureau reveal that 1,065,105 household electric refrigerators were sold in the United States in 1933. This total, while somewhat below the estimate for the year made by the Bureau in November, when the six preceding months had set new comparative all-time records, was nevertheless slightly higher than the December forecast made when the November figures had shown a sharp drop for that month.

The 1933 total compares with 769,920 unit sales in 1932 and 948,779 in 1931, the industry's previous peak year. With the year's national quota set at approximately 800,000 units the sales for the twelve months represent a quota realization of 132.7 per cent.

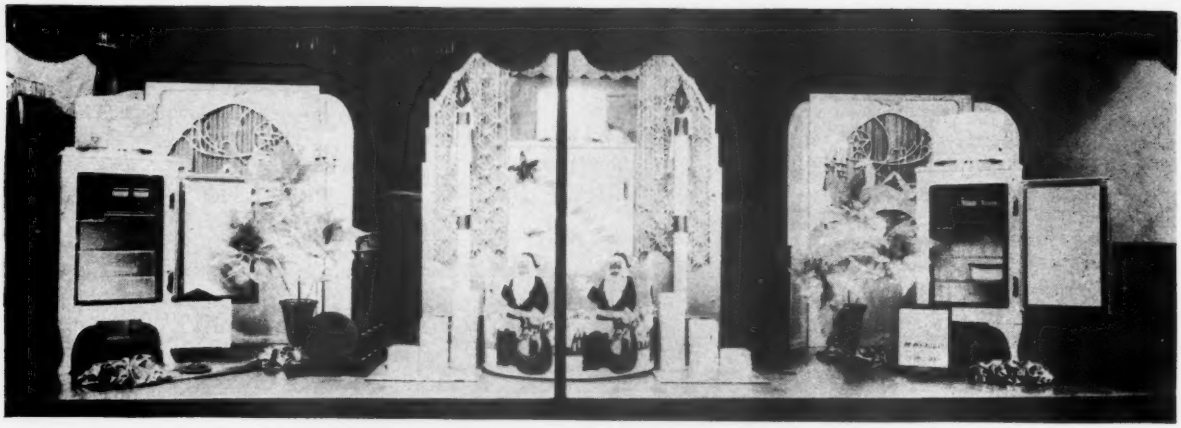
Only twelve of the forty-eight States failed to reach their quotas and nine of those twelve scored better than 90 per cent. Georgia registered the highest percentage, 180.9, while Nevada finished in second place with 180.6 per cent. Alabama with 178.8, Texas with 178, Virginia with 175.6, Maryland and District of Columbia with 172 and Missouri with 168.8 were the other outstanding leaders.

In the matter of total unit sales, New York led the way with 205,383, nearly 20 per cent of the total for the entire country, while Pennsylvania ranked second with 103,564.

Among the various regional divisions, the Southeastern Division led all the others in quota realization with a percentage of 160.6. This division includes Alabama, Florida, Georgia, North Carolina, South Carolina, Tennessee and Virginia. The East Central Division, which includes Ohio and the border States of Kentucky and West Virginia, was second with 155.1 per cent. The Eastern Division, which includes Delaware and Maryland in addition to New York, New Jersey and Pennsylvania, was third with 152.7 per cent, and the Southwestern Division, consisting of Arkansas, Louisiana, Mississippi, Oklahoma and Texas, was fourth with 143.6 per cent. All of which would seem to bear out the often reiterated statement

ELECTRIC REFRIGERATION BUREAU
SALES—HOUSEHOLD MODELS ONLY—TOTAL YEAR 1933

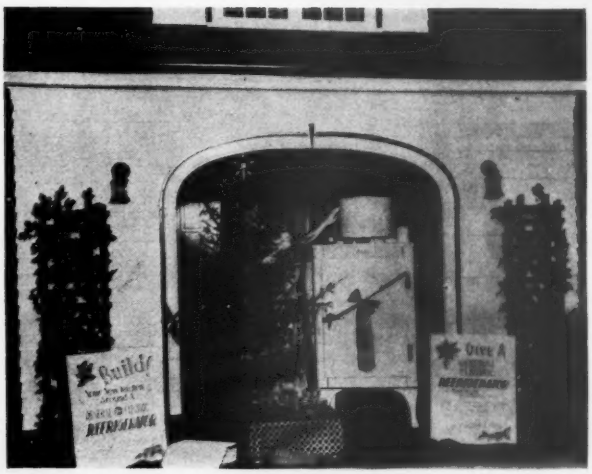
	YEARS QUOTA	ESTIMATED TOTAL SALES	% QUOTA REALIZATION
New England Division			
Connecticut	15,316	17,740	115.8
Maine	6,234	5,699	91.4
Massachusetts	39,027	53,436	136.9
New Hampshire	4,009	3,900	97.2
Rhode Island	6,435	9,177	142.6
Vermont	2,626	2,767	105.3
Eastern Division			
Delaware	1,607	2,343	145.7
Maryland & D. C.	15,944	27,432	172.0
New Jersey	39,021	50,654	129.8
New York	123,949	205,383	165.6
Pennsylvania	68,754	103,564	150.6
East Central Division			
Kentucky	8,934	14,682	164.3
Ohio	51,228	69,328	135.3
West Virginia	6,149	10,207	165.9
Middle West Division			
Iowa	15,232	14,013	91.9
Kansas	11,343	12,145	107.0
Missouri	22,078	37,270	168.8
Nebraska	7,837	8,746	111.5
Pacific Coast Division			
Arizona	2,295	2,418	105.3
California	62,735	62,163	99.0
Nevada	569	1,028	180.6
North West Division			
Idaho	2,582	2,311	89.5
Montana	2,785	3,524	126.5
Oregon	7,893	7,491	94.9
Utah	3,850	4,444	115.4
Washington	14,270	11,807	82.7
South Eastern Division			
Alabama	5,470	9,785	178.8
Florida	7,687	10,575	137.5
Georgia	6,537	11,828	180.9
North Carolina	8,601	14,103	163.9
South Carolina	3,427	5,589	163.0
Tennessee	7,830	9,793	125.0
Virginia	8,733	15,341	175.6
Great Lakes Division			
Illinois	61,455	72,446	117.8
Indiana	22,386	22,863	102.1
Michigan	35,191	33,694	95.7
Wisconsin	20,689	17,984	86.9
North Central Division			
Minnesota	15,809	14,943	94.5
North Dakota	1,996	1,876	93.9
South Dakota	2,558	2,546	99.5
Rocky Mountain Division			
Colorado	6,745	8,541	126.6
New Mexico	1,091	1,724	158.0
Wyoming	1,045	1,408	134.7
Southwestern Division			
Arkansas	3,664	5,553	151.5
Louisiana	6,525	7,587	116.2
Mississippi	2,742	3,327	121.3
Oklahoma	8,346	12,634	151.3
Texas	20,941	37,293	178.0
Totals	802,170	1,065,105	132.7



Above — Southern Colorado Power Co., Pueblo, Colo. 1st Prize — Central Station More Than 100 sq. ft.

Left — Consumers Power Co., Jackson, Mich. 1st Prize — Central Station Less than 100 sq. ft.

Below, left—Lynn Gas and Electric Co., Lynn, Mass. 2nd Prize — Central Station More Than 100 sq. ft.



Below, right — Blackstone Valley Gas and Electric Co., Pawtucket, R. I. 2nd Prize —Central Station Less Than 100 sq. ft.

that it is the South which is leading the way in our national recovery from the depression.

WINNERS ANNOUNCED IN HOLIDAY DISPLAY CONTEST

With 340 entries, representing every section of the country, the Electric Refrigeration Bureau's national Christmas Holiday Window Display contest held during the recent holiday period, was the most successful, in the number of contestants, quality of exhibits and keenness of competition, of any similar activity ever sponsored by the Bureau.

Contestants from forty of the forty-eight States, and representing communities ranging all the way from the largest metropolitan centers to towns of less than 10,000 population, entered the competition, and the judges required the better part of two days to determine the

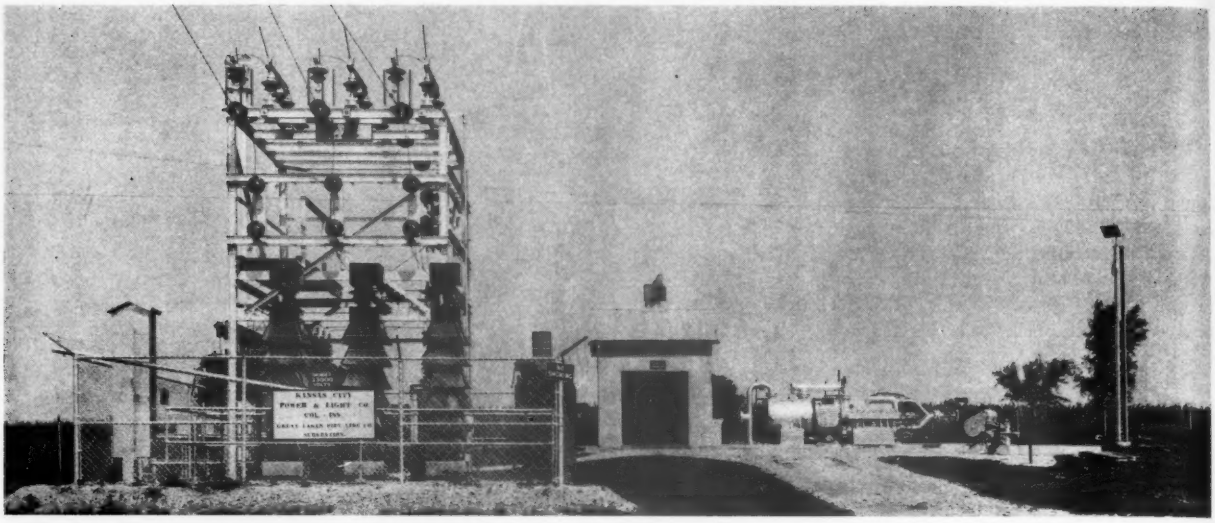
(Continued on page 61)

Above, right — Emmons Hawkins Hardware Co., Huntington, W. Va., 1st Prize Dealer Less Than 100 sq. ft.

Center, left — The Golden Rule, St. Paul, Minn. 2nd Prize. Dealer More Than 100 sq. ft.

Center, right—Fowler, Dick and Walker, Binghamton. N. Y. 2nd Prize. Dealer Less Than 100 sq. ft.

Left—Tull & Gibbs, Spokane, Wash. 1st Prize. Dealer More Than 100 sq. ft.



Service from Kansas City Power and Light Company to Bonita station of Great Lakes Pipe Line Company. Outdoor pump installation in background.

ELECTRIC SERVICE FOR OIL AND GASOLINE PIPE LINE PUMPING

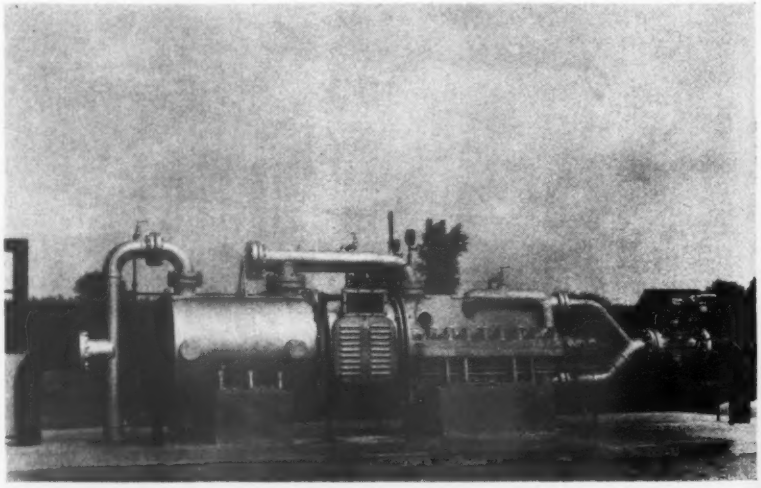
By W. H. STUEVE*

Since the publication in January, 1932 of N.E.L.A. Report No. 25, "Electric Service for Oil and Gasoline Pipe Line Pumping," electrification of pipe line pumping stations has progressed at a most satisfactory rate, in consideration of economic conditions during the period. Although it was only in 1925 that the first use of electric power for pipe line pumping was made, its advantages so quickly became apparent that 80 per cent of the power installed in pumping stations in 1933 was electric, the remaining 20 per cent being provided by oil engine.

The earlier report, based on data of 1930, covered a total installation of 165,960 hp. in electric pumping stations. Data for 1931 showed an increase to 181,160 hp., while installations made in 1932 added 30,500 hp. to the total. There remains, however, in excess of 600,000 hp. in oil engine and steam trunk line stations in the United States, which very substantial figure suggests the potential load to be gained through replacements with electric power as obsoletion makes the earlier type of drive uneconomical in operation.

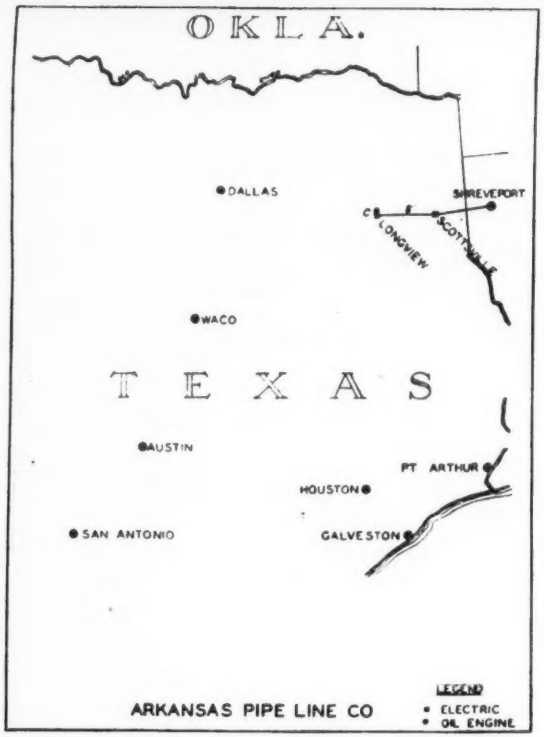
As was pointed out in Report No. 25, and as has been emphasized by subsequent developments, the low initial investment, low maintenance costs, the flexibility of electric units, reasonable electric rates and adaptability to automatic operation have made electric pumping stations the logical answer to the requirement of pipe line operators. The responsibility for the further development of this field is largely with the electric utilities. Its great possibilities warrant the most serious consideration.

Among the more interesting recent developments have been the installation in the East Texas Oilfield of a considerable number of electrified oil pumping stations to handle oil to Gulf ports and surrounding territory, and the installation of fifteen booster stations by the Great Lakes Pipe Line Company on



Rannett type pipe line pump. Totally enclosed motor is cooled by gasoline flowing through pipe line.

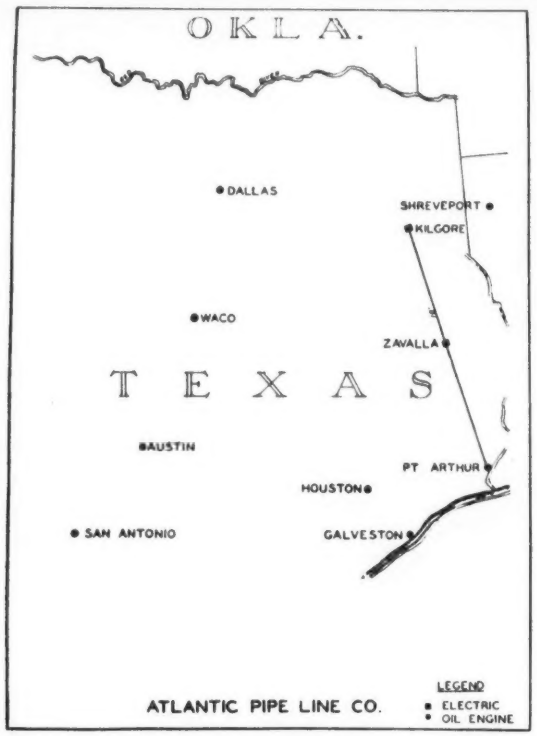
* Member, Industrial Power and Heating Subcommittee, W. H. Sammis, Chairman.



ARKANSAS PIPE LINE COMPANY

Shreveport, Louisiana

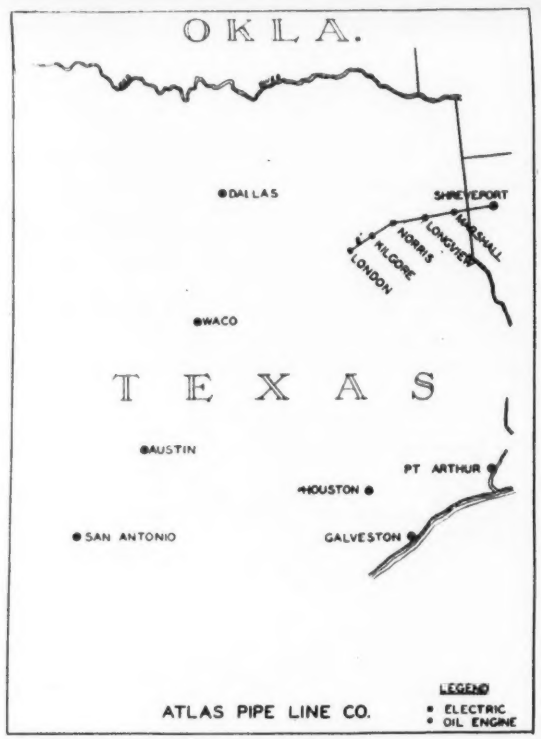
This pipe line consists of 90 miles of 8-inch pipe and is installed from Longview in the East Texas Oilfield to their refinery in Shreveport, Louisiana. The capacity of the line is 25,000 B/D at 700 pounds. The Longview Station is a combination Gas Engine and Electric Station. The electric equipment consists of 2—150 hp. 3600 r.p.m. induction motors driving centrifugal pumps. The Scottsville Station has installed 2—250 hp., 3600 r.p.m. induction motors driving centrifugal pumps. The total connected load is 800 hp.



ATLANTIC PIPE LINE COMPANY

Dallas, Texas

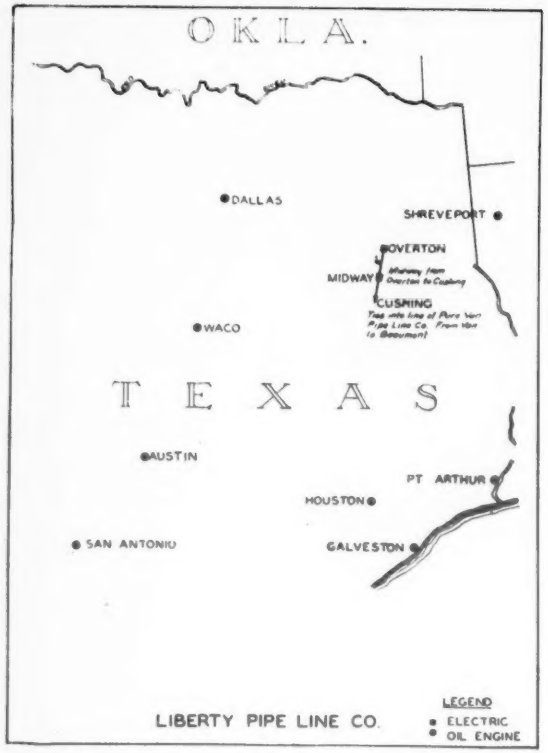
This pipe line approximately 182 miles long of 10-inch pipe was installed from Kilgore in the East Texas Oilfield to Port Arthur, Texas. There are two electric stations installed at Kilgore and Zavalla. The capacity of the line is 25,000 B/D at 750 lbs. per square inch working pressure. At each of the stations they have installed 2—250 hp. induction motors 3600 r.p.m. driving centrifugal pumps. The total hp. is 1000.



ATLAS PIPE LINE COMPANY

Shreveport, Louisiana

This pipe line of 8-inch pipe is approximately 90 miles long and extends from London in the East Texas Oilfield to Shreveport, Louisiana; the capacity of the line is approximately 32,000 barrels per day with working pressure of 700 pounds per square inch. The Norris Station contains 1—250 hp., 3600 r.p.m. motor driving centrifugal pump. The working pressure is approximately 350 pounds per square inch. The London and Kilgore stations each have installed 2—250 hp., 3600 r.p.m. induction motors driving centrifugal pumps. The total hp. installed is 1,250.



LIBERTY PIPE LINE COMPANY

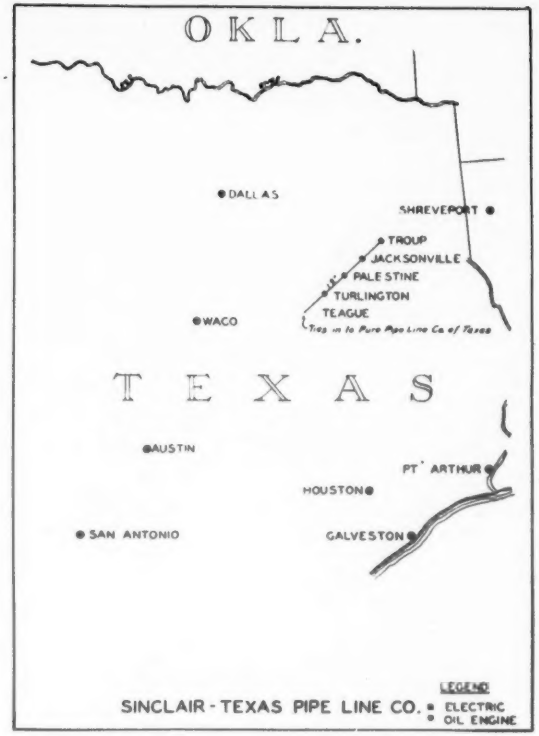
Longview, Texas

This pipe line consists of approximately 50 miles of 8-inch pipe and extends from Overton in the East Texas Oilfield to a point south of Cushing, Texas, where it ties into the main line of the Pure-Van Pipe Line Company. The capacity of the line is 30,000 barrels per day at 1700 lbs. The equipment in the Overton Station consists of 2—150 hp., 3600 r.p.m. induction motors driving centrifugal pumps and the equipment at the Midway Station consists of 1—250 hp., 3600 r.p.m. induction motor driving a centrifugal pump. The total connected load is 550 hp.

SHELL PIPE LINE CORPORATION

St. Louis, Missouri

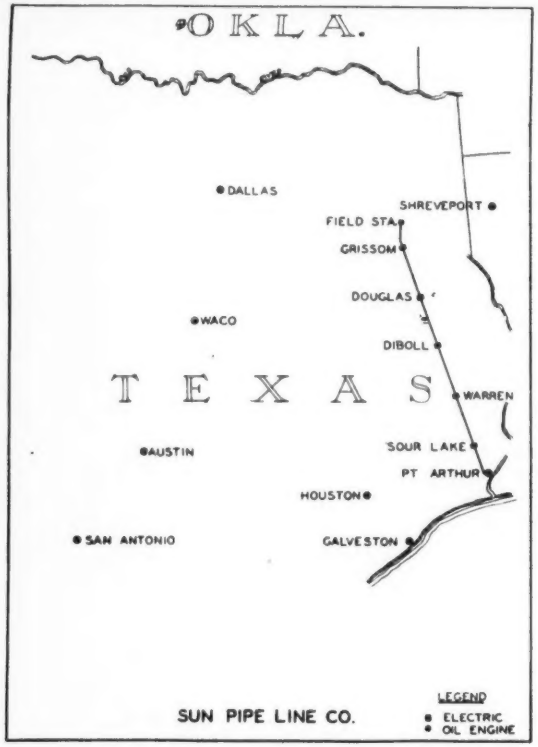
This pipe line of 10-inch pipe is approximately 200 miles long and extends from Kilgore in the East Texas Oilfield to Houston on the Gulf. There are three stations on the line, each station containing 2—300 hp. motors driving reciprocating pumps. The capacity of the line is approximately 45,000 barrels per day with working pressure 700 pounds per square inch. The total hp. installed is 1800.



SINCLAIR-TEXAS PIPE LINE COMPANY

Tulsa, Oklahoma

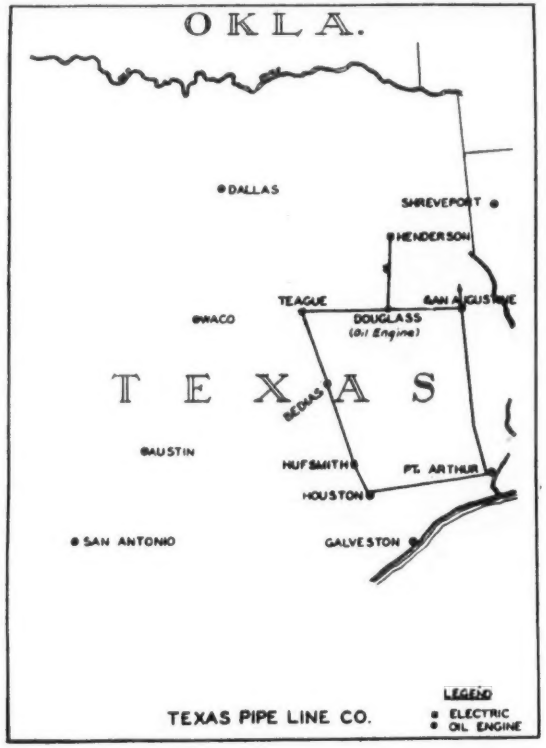
This pipe line of 12-inch diameter is approximately 125 miles long and extends from Troup to Teague Texas, where it ties into the system of the Pure Oil Pipe Line Company of Texas. The capacity of the line is approximately 80,000 barrels per day at 700 lbs. per square inch. There are four electric stations on this line each containing 2—500 hp., 3600 r.p.m. induction motors driving centrifugal pumps. The total hp. installed is 4000.



SUN PIPE LINE COMPANY

Beaumont, Texas

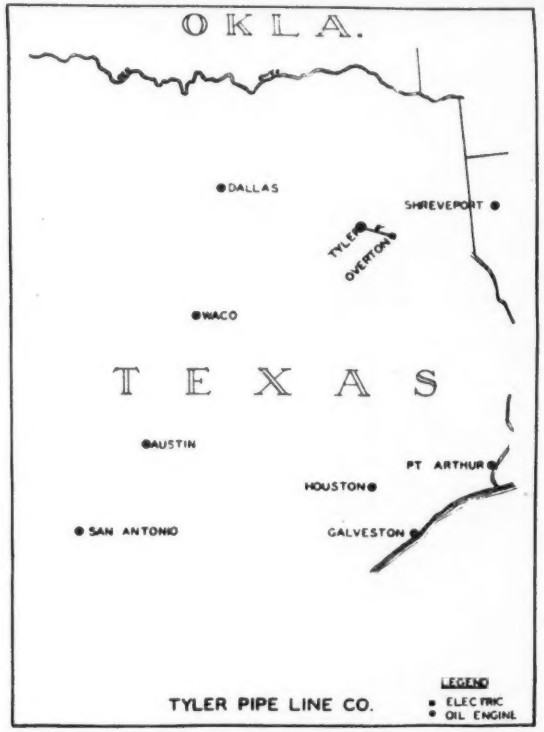
This pipe line of 10-inch diameter is approximately 190 miles long extending from Kilgore to Beaumont. The capacity of the line is approximately 45,000 barrels per day with working pressure 700 lbs. per square inch. The equipment installed consists of 300 hp. and 400 hp. motors, 3600 r.p.m., driving centrifugal pumps. The total hp. installed is 2400 hp.



TEXAS PIPE LINE COMPANY

Houston, Texas

In order to serve the East Texas Oilfield, this Company installed approximately 60 miles of 10-inch line from Henderson to Douglass, where the line tied in with previous existing pipe lines to serve both Houston and Port Arthur. Electric stations were installed at Henderson, St. Augustine, Teague, Bedias, and Hufsmith. At each of these stations there were installed 2—300 hp., 1800 r.p.m. induction motors driving centrifugal pumps or a total of 3000 hp.



TYLER PIPE LINE COMPANY

Tyler, Texas

This pipe line approximately 30 miles long of 8-inch pipe was installed from Overton in the East Texas Field to the Refinery at Tyler, Texas. The capacity of the line is 25,000 barrels per day at 600 lbs. per square inch working pressure. The equipment in the Overton Station consists of 2—200 hp. motor driven plunger pumps. The total connected load is 400 hp.

lines running from the Oklahoma fields. The East Texas group has approximately 15,000 electric hp. connected and the Great Lakes 7700 hp. Other installations have been made in the Oklahoma, Kansas, Missouri, Iowa, Illinois, Minnesota and Louisiana during the past two years.

This report, prepared as a supplement to N.E.L.A. Report No. 25, contains brief descriptions of the stations, and maps showing the approximate station location of all of the totally electrified pipe lines from the East Texas Oilfield to the Gulf of Mexico, and a map and description of the Great Lakes Pipe Line Company installations†.

The following table gives the approximate electric hp. connection for the nine pipe line companies operating lines from the East Texas Oilfield to the Gulf:

Company	*Home Office*	*Electric HP. Installed*
Arkansas P.L. Co.	Shreveport, La..	800
Atlantic P.L. Co.	Dallas, Tex. . .	1,000
Atlas P.L. Co.	Shreveport, La.	1,250
Liberty P.L. Co.	Longview, Tex.	550
Shell P.L. Co.	St. Louis, Mo..	1,800
Sinclair-Texas P.L. Co.	Tulsa, Okla. . .	4,000
Sun P.L. Co.	Beaumont, Tex.	2,400
Texas P.L. Co.	Houston, Tex..	3,000
Tyler P.L. Co.	Tyler, Tex. . . .	400
TOTAL		15,200

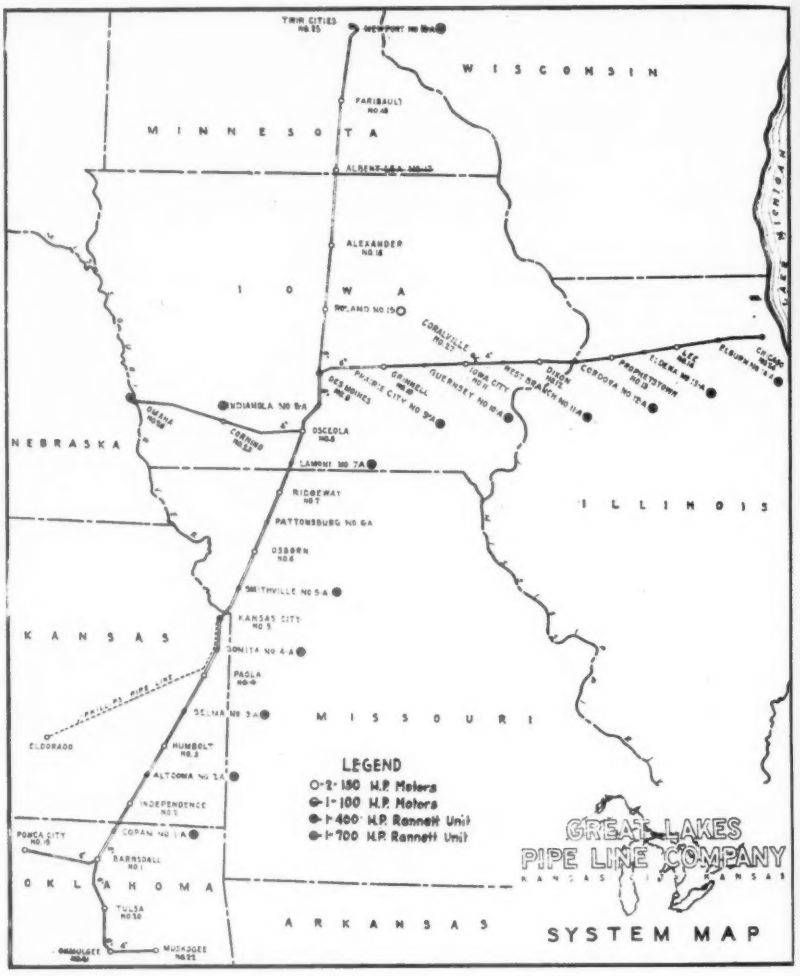
†Further information on the Great Lakes Company installations is carried in the December, 1933, E. E. I. Bulletin, P. 288.

Oklahoma Utilities Association Convention

The Oklahoma Utilities Association will hold its Sixteenth Annual Convention on March 6 and 7 at Tulsa. All sessions will be at the Mayo Hotel. This Association embraces all branches of the utility industry and its conventions are largely attended, having exceeded 1000 in 1929 and '30. There will be general sessions both days, with division sessions for election of division officers, and with special programs on the two afternoons for the Telephone Division.

There will be a dinner on the night of March 6, with Edwin Downey, of Little Rock, Arkansas, attorney for the Southwestern Bell Telephone Company, as principal speaker.

The presidency of this Association rotates among the several divisions. Present officers are R. J. Benzel, Southwestern Bell Telephone Company, Oklahoma City, president; H. B. Cobban, Northeast Oklahoma Railroad Company, Miami, first vice-president; W. B. Head, Jr., Oklahoma Power & Water Company, Sands Springs, second vice-president; W. R. Emerson, Oklahoma Gas & Electric Company, Oklahoma City, treasurer, and E. F. McKay, Oklahoma City, manager.



GREAT LAKES PIPE LINE COMPANY

Kansas City, Missouri

This pipe line consists of approximately 400 miles of 8-inch line from Oklahoma to Des Moines, Iowa, and 6-inch laterals from Des Moines to Chicago, and Des Moines to Omaha. A combination 6-inch and 4-inch line is installed from Des Moines north to Minneapolis. A gathering system of 6-inch and 4-inch pipe lines is located in Oklahoma for connection to refineries that produce the gasoline, which gathering system delivers to originating station. The 8-inch pipe line from Oklahoma to Des Moines has installed 7—700 hp. electric centrifugal pumps, capacity approximately 35,000 barrels per day. The 6-inch pipe lines have installed 6—400 hp. electric centrifugal pumps, handling capacity approximately 20,000 barrels per day. 1—300 hp. pump, and 1—100 hp. pump complete the installation on this system.

Electric pump units are known as the Rannett pumps. A special designed composite pumping unit wherein the incoming stream of gasoline cools the motor and then passes to the 8-stage centrifugal pump. The pumping unit is erected outdoors without housing and is controlled with semi-automatic electric control switches.

DAMAGE TO WOOD POLES AND CROSS ARMS CAUSED BY LIGHTNING*

This report presents the results of an investigation of wood pole and cross arm damage from lightning in order to obtain authentic information on the amount and seriousness of such damage, and to determine to what extent preventive measures are effective and warranted. Information obtained from 120 companies, widely scattered throughout the United States and Canada, on replies to a questionnaire is summarized, the use of pole ground wires and overhead ground wires is discussed, and detailed information, as reported by certain companies, is given. A statement of conclusions is included.

Since the first lines were built for the transmission of electrical energy, the effects of lightning disturbances on line operation and maintenance has been of serious concern to designer and operator. Operators complained of pole and cross arm damage and designers came to their aid with the pole ground wire, which was considered a satisfactory solution for several years.

With increasing demands on service more attention is being given to momentary surges and short interruptions due to their effects on industrial equipment. The pole ground wire thus appears as the cause and not preventive of interruptions, for the use of this ground wire on wood pole lines materially reduces the flashover value to ground of the otherwise highly insulated poles in the line, probably increasing the number of flashovers. The question arises as to whether or not the pole ground wire is justified when its detrimental effects are given full consideration. With this in mind the Southeastern Geographic Division sent a questionnaire to its member companies to obtain a definite opinion of the operators as to whether or not the pole ground wire eliminated enough trouble from shattering to justify its expense and the increased number of flashovers which would be expected as a result of its use. So much interest was manifested that it was then taken as a topic for more general consideration and the questionnaire revised and distributed nationally.

A total of one hundred and twenty replies to the questionnaire were received, with some from each of the geographic divisions of the former National Electric Light Association. The number of replies received from each division is given in Table I in order to show the territory covered by the replies received. The replies were tabulated and analyzed in this grouping for convenience and so that comparisons could be made between the replies received and government reports for lightning distribution over the country.

SUMMARY OF RESULTS

Meager Records Kept on Damage

One of the most interesting points brought out in the summary is that only one-third of the companies reporting keep records of the damage caused by pole and cross arm shattering, yet, figuring on an average percentage basis, twenty-two per cent of the lines of these companies are equipped with pole grounds. This figure is somewhat misleading because for a true value, the total number of poles involved would have to be considered, and not percentage values, which were all that were available. The value given, however, is fairly representative and very likely not far from the true one.

Pole Ground Wires

The replies as to opinion regarding the use of pole ground wires are also interesting. Thirty-eight per cent of the replies were against pole grounds of any kind, sixteen per cent favored solid grounds, thirteen per cent favored ground with gaps and the remaining twenty-three per cent were non-committal, probably due to lack of experience with and information on ground wires with gaps. The use of bonds on cross arms is advocated by only a few companies, five per cent favoring bonds without gaps, three per cent favoring gaps, fifty-five per cent favoring no bonds at all and the remaining thirty-seven per cent being noncommittal. Pole grounds protect the poles against damage from lightning but do not protect the cross arms unless they are bonded to the ground wire.

Cost of Damage

Only two companies reported keeping any record of the cost of damage caused by shattering and two reported that the rotting of poles and cross arms starting from lightning damage was of serious proportions.

Overhead Ground Wire

Twenty-four companies reported having no damage to poles and cross arms where lines were equipped with overhead ground wire and twenty-five reported having some damage with lines so equipped. The practice in grounding the overhead wire varies from each pole to every mile, the average being about every third pole. Some companies experience damage to arms on poles where the overhead ground wire is grounded at each pole. The foregoing figures for damage are about equally divided between lines where overhead ground wires are frequently grounded, that is every pole or every other pole, and lines where overhead ground wires are grounded every fifth or sixth pole.

Practice Compared With Lightning Distribution

Forty-six per cent of the companies keeping records are in the Southeast, Southwest and Middle West Divisions. This territory includes the portion of the country where lightning storms are most frequent and severe, as shown in Figure 1, which is a map reproduced from the U. S. Bureau of Standards, Miscellaneous Publication No. 95, "Protection of Electrical Circuits and Equipment against Lightning." There are no definite records as to the severity of the thunder storms, but according to information available from government records the intensity is most severe at the center of the United States with an arm of slightly diminishing intensity extending toward Florida and with rapidly diminishing intensity toward the West, North and Northeast.

The use of the overhead ground wire in those same divisions is only slightly above the average for the country, being considerably greater in some of the other divisions where lightning is not so severe. The same is practically true for the pole ground wire. In the North Central division four out of the six companies reporting have all poles on their system grounded, the average for this division being the highest for the country, whereas lightning is much less frequent here than in other parts of the country. The ratio of those companies favoring no pole grounds to those favoring some

* A report sponsored by the Overhead Systems Committee of the former National Electric Light Association. Prepared by J. Coleman Jones, of the Overhead Systems Committee, Southeastern Geographic Division. Approved for printing by Mark Eldridge, *Chairman*, Transmission and Distribution Committee, E.E.I.

TABLE I—SUMMARY OF REPLIES TO QUESTIONNAIRE

Geographic Division Number* (See footnote)	Total No.	%	1	2	3	4	5	6	7	8	9	10	11	12	13
Number of reports received	120		8	10	10	13	2	16	9	6	12	8	6	11	9
Companies keeping records	41	34.1	2	2	2	4	0	6	3	0	5	2	2	7	6
Companies not keeping records	79	65.9	6	8	8	9	2	10	6	6	7	6	4	4	3
Maximum poles per mile damaged annually	.54		.090	.100	.540	.357	–	.51	.033	–		.041 .003	0	.300	.252
Average poles per mile damaged annually	.09		.090	.056	.280	.188	–	.224	.003	–		.011 .003	0	.040	.080
Maximum poles per mile replaced annually	.15		.070	.012	.018	.028	–	.010	.003	–		.014 –	0	.025	.156
Average poles per mile replaced annually	.01		.070	.006	.015	.021	–	.005	.003	–		.003 –	0	.011	.033
Maximum cross arms per mile damaged annually	.54		.050	.094	.540	.500	–	.325	.002	–		.070 –	.055	.300	.220
Average cross arms per mile damaged annually	.08		.050	.080	.270	.167	–	.151	.002	–		.005 –	.027	.036	.055
Average percentage of grounded poles		22.1	4.5	7.8	17.6	4.3	0	16.3	28.2	66.7	30.0	3.4	31.5	20.6	56.4
Companies with gaps in pole grounds	15	12.5	0	1	3	0	0	2	0	0	1	0	3	2	3
Companies with arms grounded	31	25.8	0	3	2	0	0	6	4	1	2	2	3	3	5
Average percentage of overhead ground wires		17.1	2.6	21.2	34.5	9.6	0	17.2	14.6	41.6	14.2	–	28.1	17.4	20.9
Companies favoring gaps in pole grounds	16	13.3	1	0	3	0	0	3	1	0	0	0	2	4	2
Companies favoring solid pole grounds	19	15.8	0	1	3	1	0	5	1	2	2	0	1	0	3
Companies favoring no pole grounds	45	37.5	4	5	3	9	0	4	3	0	6	3	1	4	3
Companies favoring gaps in cross arm bonds	4	3.3	0	0	0	0	0	0	1	0	0	0	0	1	2
Companies favoring no gaps in cross arm bonds	6	5.0	0	1	0	0	0	1	0	1	0	0	2	0	1
Companies favoring no cross arm bonds	67	55.8	5	5	8	10	0	10	4	1	8	3	3	6	4

NOTE: The average values for pole and cross arm damage in each division are obtained by taking an average of the figures for damage per mile as reported by those companies keeping such records. The average for all companies keeping records was obtained by taking the average of all the figures reported by the various companies. A more representative average could have been obtained if the miles of line covered by each report were known so that weighted averages could have been taken.

The average percentage values for grounded poles were taken as an average of the percentage figures reported by each company.

*Geographic Division No. 1 is the Canadian Division; No. 2, Eastern; 3, East Central; 4, Great Lakes; 5, Middle Atlantic; 6, Middle West; 7, New England; 8, North Central; 9, Northwest; 10, Pacific Coast; 11, Rocky Mountain; 12, Southeastern; 13, Southwestern.

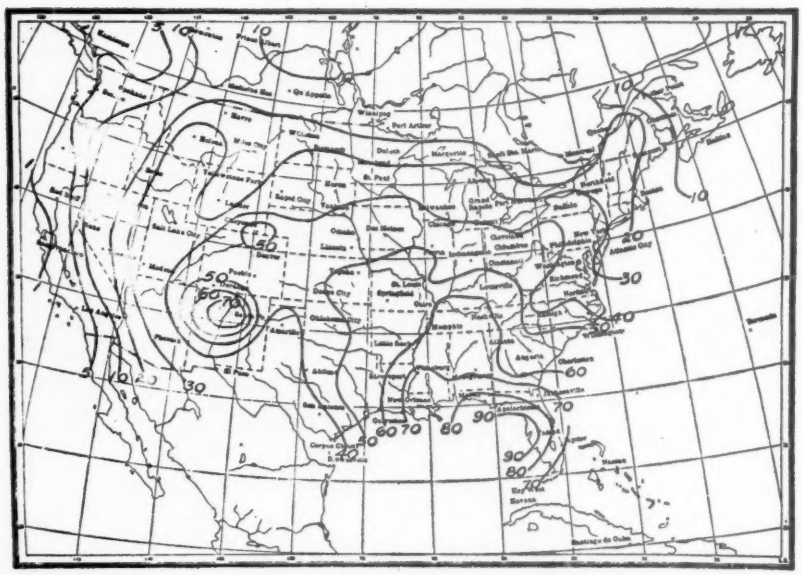


Fig. 1—Average number of days per year on which thunderstorms occur.

form of pole grounds is 45:25 for the entire country, whereas it is 11:17 for these same three divisions.

Detailed Report on Lightning Damage

Table II summarizes a detailed report made by one company showing damage to poles and cross arms for the year 1927 and 1928. During these two years a special patrol was made of the entire system, consisting of eight hundred miles of single and double circuit. Sixty-six and thirty-three kv pin type lines were without overhead ground wires and twenty per cent of the poles were grounded. A detailed report was made of each pole which showed any signs of lightning damage, regardless of

TABLE II—SUMMARY OF LIGHTNING DAMAGE TO POLES AND CROSS ARMS FOR YEARS 1927 AND 1928

	Number	*Per Cent Damaged Annually*
Miles of pole line	811	
Total of structures	14,600	1.47
Total of guyed structures in line	4,900	
*Guyed structures damaged per year due to lightning	159	3.22
Total of structures not guyed	9,700	
*Structures not guyed damaged per year due to lightning	54	.61
Total of structures grounded	2,900	.00
*Poles replaced per year due to lightning damage	3	
*Poles damaged per year due to lightning	146	
*Top cross arms damaged per year due to lightning	122	
*Middle cross arms damaged per year due to lightning	5.5	
Bottom cross arms damaged per year due to lightning	20	

* One-half of cases of damage for two-year period.

its severity. In sixty-eight per cent of the cases of damage, the pole received some of the damage and in fifty-seven per cent the top cross arm was involved. More interesting, however, is the comparison of damage to guyed poles to that on unguyed poles, the ratio being about five to one, notwithstanding that only one-third of the poles were guyed. This demonstrates the detrimental effects of an incidental ground, such as a guy, in decreasing the lightning sparkover value of the structure, thus making it more susceptible to lightning damage when not totally protected, as by a pole ground wire. This survey was discontinued as it was felt that the damage found was not serious enough to justify it.

On this same system is was necessary to bond and ground arms and poles in some locations to prevent pole burning. On one section of 66 kv line sixty miles long, the total number of flashovers located from ground patrols for the years 1927 and 1928 was twenty-six. Every guyed pole, which was every third pole, was then bonded and grounded and the total number of flashovers for the years 1929 and 1930 was seventy-five, almost three times as many as for the two years preceding the bonding and grounding program. The thirty-seven flashovers reported on this line during 1930 were all on ground poles. The flashovers referred to are those located by evidence of power arcs, presumably resulting in line interruptions.

On this entire system twenty per cent of the poles were bonded and grounded, whereas, during 1930 there were six times as many cases of flashover reported on grounded poles as on ungrounded poles. During this year there were one hundred and forty-two flashovers reported from ground patrols on two hundred and four miles of line, an average of seven-tenths flashovers per mile. This is equivalent to eighty-six per cent of the flashovers on twenty-five per cent of the lines and on these two hundred and four miles of line every guyed pole was bonded and grounded, these being the only lines where all guyed poles were bonded and grounded.

In interpreting the above data, it should be kept in mind that the figures on flashover are based upon observations from patrols and not interruptions due to flashovers. Because of the tendency of the arcs to hug the insulators where the hardware is bonded or grounded, arc damage to the porcelain is undoubtedly greater than in cases where the hardware is not bonded or grounded. For this reason, less damage would be observed on patrol under the latter condition. It is recognized that in the case of direct lightning stroke a power arc flashover is to be expected irrespective of the condition of bonding or grounding, and that a surge may travel one or more spans to flashover at a grounded or guyed point of low insulation value. Caution should accordingly be exercised in using these data as a direct measure of the increase in susceptibility of a line to lightning flashover interruption from grounding or bonding of hardware. A substantial increase in such susceptibility is, however, undoubtedly indicated.

The territory covered by this system is in a section of the country where the average number of storms per year is about eighty, as shown on the map in Figure 1, the maximum for this country being ninety. The experience of this company, where lightning conditions may be considered extremely severe, should discourage the use of the pole ground wire except in special cases.

One company in northern Illinois, with a considerable amount of 33 kv, all-wood construction, has contributed information of considerable interest on damage to structures by lightning.

This company reports structure damage to all-wood construction to be of substantially the same amount as with the conventional type of construction. The all-wood construction makes use of pin type insulators, wood cross arm braces, and wood guy insulators, with one conductor carried on a ridge iron and the other two conductors carried on a ten-foot cross arm installed six feet below the top of the pole. The conventional construction makes use of pin type insulators and steel cross arm braces with all three conductors carried on a ten-foot cross arm at the top of the pole.

The data on damage are shown below:

	No. of cases of damage per 100 miles of line	
	1930	*1931*
Severe damage to poles or cross arms, with conventional construction	3.22	5.68
Severe damage to poles or cross arms, with all-wood construction	3.34	4.7

By "severe damage" is meant those cases where repairs on account of damage by splintering or shattering are required. Minor damage, that is, those cases where repairs were not necessary, was accurately reported only on the all-wood construction and amounted to between one and two per cent per year of the total number of structures. The cross arm damage was in general substantially less than the pole damage.

Investigations of the splintering indicated that the splintering in many cases did not start from bolts by which the hardware was attached to cross arms or poles, or by which the guys or cross arms were attached to the poles. This leads to the belief that clamp-type fittings would not diminish the damage by lightning to the equipment, although they would, of course, be beneficial in holding the parts together when severe damage does occur. An example of this is the ridge iron supporting the middle conductor at the top of the pole. This is fastened to the top of the pole by two through bolts. In general, any splintering which occurred at the top of the pole started from the corners of the ridge iron rather than at the through bolts. There have been some cases, however, in which the poles were split through the bolt holes.

Three different styles of wood guy insulators are in use: The first consists of two thirty-inch wood sections in series without horns; the second consists of a nine-foot wood section protected by horns having a clear air gap of seventy-eight inches; and the third consists of a seven-foot wood section with a clear air gap of forty inches. Considerable shattering due to lightning was experienced with the first style and it was concluded that horns would be necessary to prevent this. No damage has occurred to the other two styles, although the air gap on the second is somewhat greater than has been generally recommended. There are about one hundred and fifty of these in service in comparison with about thirteen hundred of the third class. A considerable portion of the insulators in the second class were used as replacements of those in the first class which failed. Experience has shown that the seven-foot insulators with the forty-inch air gap are more susceptible to maintenance of the power-follow arc across the gap than with the other types. This effect is, of course, dependent to a large extent on the length of path over wood between the guy attachment and the conductors.

Types of Construction

The types of construction covered by these reports include practically all conceivable designs of lines using wood poles and wood or steel arms, both pin

type and suspension. The variety was so great that no particular analysis and comparison could be made which would show any conclusive information as to the advantages or disadvantages of the different types with reference to shattering by lightning.

Conclusions

The following conclusions can be drawn from the data and other information received:

1. Ground wires, either overhead or on the pole, protect the pole from damage due to lightning discharges. The protection afforded the pole and cross arm by the overhead ground wire alone is not as complete as with the pole ground wire.
2. Bonding of the cross arm hardware protects the cross arm from damage due to lightning discharges.
3. Information submitted by several companies indicates that grounding of structures substantially increases the number of interruptions caused by insulator flashover.
4. Study of the data and also the consensus, as given in the replies, indicates that the amount of lightning damage to poles and cross arms is not serious enough to warrant grounding these parts. This conclusion was based upon consideration of construction cost and unfavorable operating results with grounded structures, from the standpoint of relative interruptions and costs of restoration of service and repairs. There are, of course, special cases where grounding of poles and cross arms to protect them against lightning damage is advisable.
5. Generally speaking, the subject of lightning damage to structures has not received thorough study by most of the operating companies.
6. The damage to poles and cross arms from lightning is only nominal in the majority of cases, and the cost of such damage accordingly appears to be relatively unimportant.
7. The rotting of poles and cross arms from damage caused by lightning is not important.
8. The use of gaps in pole grounds is still in the experimental stage.

APPENDIX

All Wood Construction

The fuller utilization of the insulating value of wood to increase the flashover value of lines is being studied and tested in a number of places throughout the country. The damage caused by shattering of poles, cross arms and guy insulators is one of the most important factors entering into this design. After two or three years of experimental installations in sections of the country where lightning is most severe, one large holding company has made a complete report on their experience. The summary of these findings as regards pole, cross arm and guy shattering is as follows:

1. Horn gaps on poles with ratio of *air gap length* to *pole gap length* of 0.35 and ratio of *clearance from horn tip to pole* to *length of pole gap* of 0.18 will quite positively prevent damage to the wood in the pole gap. On one line where the ratio of air gap to pole gap was 0.45, the wood poles were not protected from damage.
2. Horn gaps on wood guy insulators with a ratio of *air gap length* to *wood insulation length* of 0.40 and *clearance from horn tip to wood* to *wood insulation length* of .19, appear from limited data to provide quite safe protection to the wood guy insulators. In one instance protective horns with these ratios did not prevent splintering of the wood in the guy insulator.
3. Cross arm horns installed on lines with five insulator units and three feet ten inches of wood cross arm insulation in *series having a ratio of air gap* to *length of cross arm insulation* of 0.39 and also with five units and six feet six inches of wood cross arm in series having a ratio of 0.33 between *air gap* and *length of cross arm insulation,* have provided protection for the arms in all but one instance.
   The necessity for protection of cross arms from lightning damage by means of horn gaps or bonding wires varies with the type of construction. For sixty-six kv pin type designs with about two feet of wood between the insulator pin and brace attachment, no severe damage has been reported and protection does not appear to be necessary. For insulator strings of six and seven units with seven feet of wood cross arm in series, damage in some instances has been severe, even completely shattering the arm and dropping the conductor.
   From the impulse tests and also from operating data there appears to be a tendency for arcs to take a diagonal path from the conductor to the arm at some point between the insulator attachment and the pole, this characteristic being more pronounced with the shorter insulator strings and pin type construction. For the lower voltages lines (sixty-six kv and below) this feature might well be utilized to advantage for protecting the cross arm, also for decreasing the probability of insulator damage from power arcs after flashovers have taken place. It is probable that with four or five insulator units and two to four feet of unbonded cross arm, shattering will not be sufficiently serious in the usual lightning territory to warrant cross arm horns. With this arrangement the wood fibers at the end of the arm should be held together to prevent splitting, by horizontal split bolts with large washers, also using large washers on the eye bolts or by clevis clamps which fit around the end of the arm.
4. Wood pole gaps made by opening the pole grounding wires and placing bands around the poles have in some cases failed to protect guy insulators from damage with a ratio of *pole gap* to *guy insulation length* of 0.75. Also the damage to the wood between the pole bands has been so severe that pole horns are readily justified to decrease pole damage in territory where lightning storms are common.
5. Pole horn gaps with a ratio of 0.40 between *air gap* and *guy insulation length* have not prevented guy insulator damage in all cases.
   Bonding the guy anchors to the pole butt grounds by means of buried wires on a particular line where the resistances of individual grounds ranged from fifty to one thousand ohms and at the same time installing fuse flashover indicators on the pole horn gaps, indicated from very limited data that about one-half of the flashovers took place through the air gaps between the pole horns and prevented guy insulator damage while the other half flashed over the guy insulators, splintering them without blowing fuses on the pole horns. In no case was a fuse blown on the pole horns on a structure and a guy insulator damaged on the same structure. After this experience the ratio of *air gap on the pole horns* to *guy insulation length* was decreased to 0.29 on one-half of the line and to 0.33 on the other half, and in one instance a guy insulator was splintered where the ratio was 0.29.

PRIZE AWARDS FOR 1934

April 1st Last Date For Making Entries

Readers of the BULLETIN are reminded that April 1st is the last date on which entries for the Byllesby prize, the Forbes prize, the Lindemann prize, the McGraw prize, the Charles A. Coffin Award and the Martin Award can be forwarded for consideration by the Prize Awards Committee. Entries for the Hughes Award may be mailed up to April 15th.

Information on the several awards for 1934 administered by the Prize Awards Committee of the Edison Electric Institute was published in the October and November issues of the BULLETIN and is repeated on page 52 of this issue for the benefit of new subscribers. Member companies may secure from the Institute posters for bulletin board use carrying the information contained on page 52.

INTERCHANGEABLE CABLE ENTRANCES FOR UNDERGROUND TRANSFORMERS*

This report explains suggested standards for high and low voltage cable entrances for underground transformers for manhole installations on standard radial distribution systems and A.C. low voltage network installations. By their adoption cable entrances can be made readily interchangeable among all makes of transformers. These standards have the approval of both the Underground Systems Committee and the principal manufacturers of transformers. This work was completed by the Underground Systems Committee, N.E.L.A. just before its dissolution.

Objective

At present the industry has in service many makes and types of underground transformers on radial distribution and low voltage network systems. Each make requires different wiping sleeves, terminal lugs, and various methods of attaching the wiping sleeves to the case. Because of this, cable entrances are not interchangeable among the various makes of transformers. This lack of interchangeability of cable entrances on underground equipment imposes an added burden to the industry by increasing the cost of repairs and the length of time service must be interrupted to replace equipment that has failed. It also creates difficult operating and maintenance problems. To avoid these delays and problems some companies have adopted standards of their own which are made part of their transformer specifications for underground installations. If more companies adopt this procedure an undue and unnecessary burden will be placed on the manufacturers.

Interchangeability of cable entrances can be effected without affecting the design of the apparatus itself. Therefore, any standardization along these lines will not restrict the development of apparatus. This desired interchangeability of cable entrances can be accomplished by all concerned adopting the standards as set forth in this report. These standards have the approval of both the Underground Systems Committee and the manufacturers. In order that the industry as well as the manufacturers derive the maximum benefits therefrom, the Underground Systems Committee by resolution passed at the October 5, 1931, meeting in Cincinnati, urged that all companies support these recommended standards by incorporating them in their purchase specifications and that the manufacturers also adopt them as their standards.

Procedure

The first step was to obtain responsible representatives of manufacturing companies. To this end accredited representatives of the General Electric, Westinghouse, and Allis Chalmers Companies were appointed to the subcommittee. The manufacturers' representatives had full authority to agree to any proposed standards. The first problem was to pick the most universally accepted designs from the point of view of the operating companies so that a standard could be adopted, which would obtain the most general use and would impose the minimum re-tooling burden upon the manufacturers. A study of the wide variety of cable entrances in use indicated that there were two fundamentally different designs, namely, screw type of cable entrance and the bolted on type. The question was also raised as to the desirability of making a type of cable entrance by which the cable could be disconnected from the transformer without necessitating the removal of the top of the transformer. It was decided that this would not be feasible for the smaller transformers, this type of design being proposed only for the 75 and 100 kv-a single phase transformers, and the corresponding sizes of 3 phase transformers. These alternative propositions were presented to the Underground Systems Committee. As a result of this, thirty-two out of thirty-three representative member operating companies expressed themselves as favorable to the screw type of cable entrance. In reference to design whereby the cable could be disconnected from the transformer without removing the transformer top, twenty companies out of thirty-three expressed their preference for this scheme; eight gave no preference, and five expressed themselves as being not favorable to this scheme. Subsequent correspondence with these five companies resulted in their expressing a willingness to accept it.

With this preliminary work established the final proposal for a complete interchangeability as outlined in this report was accomplished. After the completion of this work a final report was circulated to all of the member companies. There were forty-six operating companies represented on the Underground Systems Committee. Forty-four replies were received, forty of which were favorable to the report and two unfavorable. One company raised certain questions which have been subsequently answered and one company stated it did not care to express an opinion as it did not use manhole transformers. In view of the overwhelmingly favorable vote on the part of the operating companies and the agreement of the manufacturing companies, this report should be incorporated in the specifications of operating companies purchasing manhole transformers and should be made a standard on the part of the manufacturing companies.

Definitions

Due to the difference in the application and the requirements for different types of underground transformers, the standards for interchangeability were drawn for two different classes of transformers, namely, standard manhole transformers and network transformers. By standard manhole transformers, either single-phase or three-phase, are meant those transformers manufactured more or less as standard distribution transformers, similar to the normal pole type unit except designed for manhole service. These transformers are supplied usually for radial distribution systems operating at a primary voltage of 4 kv or 2.3 kv. By network transformers are meant those transformers manufactured for use on a-c low voltage networks. These transformers usually present different design problems for the cable entrances in view of the fact that the terminal chamber arrangement is becoming more or less universal. Network transformers usually operate on systems having primary voltage in the neighborhood of 13.2 kv.

Cable Entrances for Standard Manhole Transformers

These proposed standards cover both primary and secondary cable entrances as follows:

1. *Low voltage cable entrances (secondary)* are covered in Figures 1 and 2

* A report of the former Underground Systems Committee, Engineering National Section, N.E.L.A., C. T. Sinclair, *Chairman*. Prepared by the Subcommittee on Standardization of Underground Equipment, L. G. Smith, *Chairman*. Approved for printing by Mark Eldridge, *Chairman*, Transmission and Distribution Committee, E.E.I.

TABLE 1
STANDARD SCREW TYPE
LOW VOLTAGE TRANSFORMER BUSHING DIMENSIONS
FOR STANDARD SINGLE PHASE MANHOLE TRANSFORMERS

TRANS. SIZE KVA	TYPE OF WIPE SLEEVE	MAXIMUM CABLE SIZE M.C.M. OR GAGE	MAXIMUM CABLE SIZE O.D. INS.	TRANS. SHELL B	TRANS. SHELL C	TRANS. SHELL D	LUG E*	LUG G*	BUSHING H	BUSHING J	BUSHING N	CLAMP SCREW† P	CLAMP SCREW† Q	CLAMP SCREW† T
5		300	1.01	13-25	1 1/8	7/8	9/16	7	1 7/8	1 1/8	1/4	15/16	2-12	2
7 1/2		300	1.01	13-25	1 1/8	1/8	9/16	7	1 7/8	1 1/8	1/4	15/16	2-12	2
10	STRAIGHT OR TAPERED SLEEVE	300	1.01	15-30	1 1/8	7/8	9/16	7	1 7/8	1 1/8	1/4	15/16	2-12	2
15		300	1.01	15-30	1 1/8	7/8	9/16	7	1 7/8	1 1/8	1/4	15/16	2-12	2
25		750	1.40	25-40	1 1/2	7/8	11/16	9	2 1/8	1 1/2	1/4	15/16	2 3/8-12	2 3/8
37 1/2		750	1.40	32-47	1 1/2	7/8	11/16	9	2 1/8	1 1/2	1/4	15/16	2 3/8-12	2 3/8
50		1250	1.80	35-54	2	7/8	+	5 1/2	2 3/4	2	1/4	15/16	3-12	3
75		1250	1.80	35-54	2	7/8	+	5 1/2	2 3/4	2	1/4	15/16	3-12	3
100		1250	1.80	35-54	2	7/8	+	5 1/2	2 3/4	2	1/4	15/16	3-12	3

Fig 1 For 5 To 37 1/2 KVA
Fig 2. For 50 To 100 KVA

+ - THIMBLE 1 3/4 O.D. - 3" LONG
* LUG FOR 5 TO 37 1/2 KVA SIZES AND THIMBLE FOR 50, 75 AND 100 KVA SIZES
† EITHER HEXAGONAL OR CASTELLATED CLAMPING SCREWS
NOTE - A REMOVABLE COVER WILL BE PROVIDED ON THE BUSHING POCKET ON THE 50 KVA SIZES AND LARGER SO THAT THE LEADS MAY BE DISCONNECTED WITHOUT REMOVING THE TOP OF THE TRANSFORMER

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TABLE 2
STANDARD SCREW TYPE
LOW VOLTAGE TRANSFORMER BUSHING DIMENSIONS
FOR THREE PHASE STANDARD MANHOLE TRANSFORMERS

TRANS. SIZE K.V.A.	TYPE OF WIPE SLEEVE	MAXIMUM CABLE SIZE M.C.M. OR GAGE	MAXIMUM CABLE SIZE O.D. INS.	TRANS. SHELL B	TRANS. SHELL C	TRANS. SHELL D	LUG * E	LUG * G	BUSHING H	BUSHING J	BUSHING N	CLAMP SCREW† P	CLAMP SCREW† Q	CLAMP SCREW† T
15		300	1.01	13-25	1 1/8	7/8	9/16	7	1 7/8	1 1/8	1/4	15/16	2-12	2
25		300	1.01	13-25	1 1/8	7/8	9/16	7	1 7/8	1 1/8	1/4	15/16	2-12	2
37 1/2		300	1.01	15-30	1 1/8	7/8	9/16	7	1 7/8	1 1/8	1/4	15/16	2-12	2
50	STRAIGHT OR TAPERED SLEEVE	300	1.01	15-30	1 1/8	7/8	9/16	7	1 7/8	1 1/8	1/4	15/16	2-12	2
75		750	1.40	25-40	1 1/2	7/8	11/16	9	2 1/8	1 1/2	1/4	15/16	2 3/8-12	2 3/8
100		750	1.40	32-47	1 1/2	7/8	11/16	9	2 1/8	1 1/2	1/4	15/16	2 3/8-12	2 3/8
150		1250	1.80	35-54	2	7/8	+	5 1/2	2 3/4	2	1/4	15/16	3-12	3
250		1250	1.80	35-54	2	7/8	+	5 1/2	2 3/4	2	1/4	15/16	3-12	3
300		1250	1.80	35-54	2	7/8	+	5 1/2	2 3/4	2	1/4	15/16	3-12	3

Fig 1 For 15 to 100 KVA
Fig 2. For 150 KVA and Larger

+ - THIMBLE 1 3/4 O.D. - 3" LONG
* LUG FOR 15 TO 100 KVA SIZES AND THIMBLE FOR 150 KVA AND LARGER SIZES
† EITHER HEXAGONAL OR CASTELLATED CLAMPING SCREWS
NOTE - A REMOVABLE COVER WILL BE PROVIDED ON THE BUSHING POCKET ON THE 150 KVA SIZES AND LARGER SO THAT THE LEADS MAY BE DISCONNECTED WITHOUT REMOVING THE TOP OF THE TRANSFORMER

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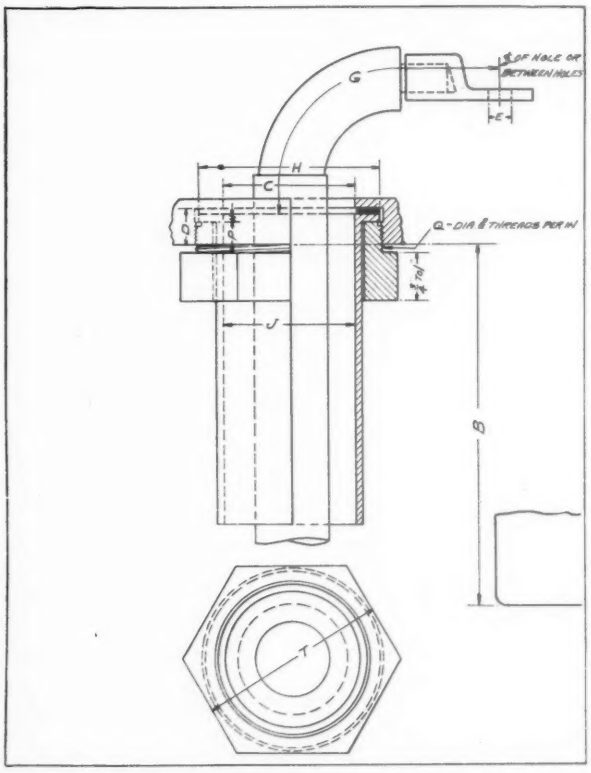

Fig. 1—Standard High and Low Voltage Cable Entrances

For standard manhole transformers, low voltage bushings for single-phase units from 5 to 37½ kv-a., and 3-phase units from 15 to 100 kv-a.
For standard manhole transformers, 4 kv. bushings—all sizes.
For 4 kv. bushings for network transformers.
For dimensions of low voltage bushings see Tables 1 and 2.
For dimensions for high voltage bushings see Table 4.

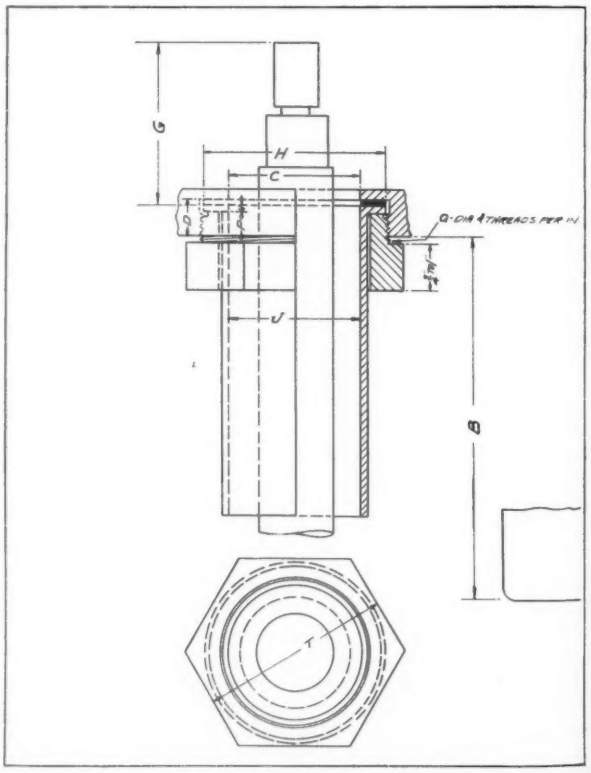

Fig. 2—Standard Low Voltage Cable Entrances

For standard manhole transformers, low voltage bushings for single-phase units from 50 to 100 kv-a., and for 3-phase units from 150 to 300 kv-a.
On these sizes of transformers a removable cover will be provided on the bushing pocket so that the leads may be disconnected without removing the top of the transformer.
For dimensions see Tables 1 and 2.

TABLE 3
STANDARD SCREW TYPE
LOW VOLTAGE TRANSFORMER BUSHING DIMENSIONS
FOR SINGLE AND THREE PHASE NETWORK TRANSFORMERS
SEE FIGURE 3

	TYPE OF WIPE SLEEVE	M. C. M. CABLE SIZE MIN.	M. C. M. CABLE SIZE MAX.	TRANS. SHELL C	TRANS. SHELL D	LUG E	LUG G	BUSHING H	BUSHING J	BUSHING N	CLAMP SCREW† P	CLAMP SCREW† Q	CLAMP SCREW† T
	STRAIGHT OR TAPERED SLEEVE	250	300	1 1/8	7/8	9/16	8 1/2	1 7/8	1 1/8	1/4	15/16	2-12	2
		350	750	1 1/2	7/8	11/16	8 1/2	2 1/8	1 1/2	1/4	15/16	2 1/8-12	2 3/8
		1000	1250	2	7/8	+9/16	8 1/2	2 3/4	2	1/4	15/16	3-12	3
		1500	2000	2 1/2	7/8	*11/16	10	3 1/4	2 1/2	1/4	15/16	3 1/2 12	3 1/2

TERMINAL CHAMBER TYPE OF CABLE ENTRANCE

+ SINGLE LEAF LUG WITH DOUBLE CONTACTS FOR REGISTERING WITH TWO LEAF TERMINAL. LEAF ON LUG TO BE 3" LONG x 1 3/8" WIDE x 3/16" THICK WITH 1 1/2" SPACING BETWEEN HOLES. G - IS DISTANCE TO LOWER HOLE IN LUG. THE LEAF SHALL BE ON CENTER LINE OF CABLE AND FLATWISE WITH THE LOW VOLTAGE SIDE OF THE TANK.

* SINGLE LEAF LUG WITH DOUBLE CONTACT FOR REGISTERING WITH TWO LEAF TERMINAL. LEAF ON LUG TO BE 3" LONG x 2 3/8"-WIDTH x 3/8 THICK WITH 1 1/2" SPACING BETWEEN HOLES. G - IS DISTANCE TO LOWER HOLE IN LUG. THE LEAF SHALL BE ON CENTER LINE OF CABLE & FLATWISE WITH THE LOW VOLTAGE SIDE OF THE TANK.

† EITHER HEXAGONAL OR CASTELATED CLAMPING SCREWS

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TABLE 4
STANDARD DIMENSIONS FOR SCREW TYPE
HIGH VOLTAGE BUSHING FOR 4 KV SINGLE AND THREE PHASE
STANDARD MANHOLE TRANS AND SINGLE PHASE NETWORK TRANS
SEE FIG. 1

TRANSFORMER SIZE KVA SINGLE PHASE	TRANSFORMER SIZE KVA THREE PHASE	TRANS. SHELL B*	TRANS. SHELL C	TRANS. SHELL D	LUG E	LUG G	BUSHING H	BUSHING J	BUSHING N	CLAMP SCREW P	CLAMP SCREW Q	CLAMP SCREW T	MAX COND. SIZE
5	15	13-25	1 1/8	7/8	9/16	6 1/2	1 7/8	1 1/8	1/4	15/16	2-12	2	#1/0
7 1/2	25	13-25	1 1/8	7/8	9/16	6 1/2	1 7/8	1 1/8	1/4	15/16	2-12	2	#1/0
10	37 1/2	15-30	1 1/8	7/8	9/16	6 1/2	1 7/8	1 1/8	1/4	15/16	2-12	2	#1/0
15	50	15-30	1 1/8	7/8	9/16	8 1/2	1 7/8	1 1/8	1/4	15/16	2-12	2	#1/0
25	75	25-40	1 1/8	7/8	9/16	8 1/2	1 7/8	1 1/8	1/4	15/16	2-12	2	#1/0
37 1/2	100	32-47	1 1/8	7/8	9/16	8 1/2	1 7/8	1 1/8	1/4	15/16	2-12	2	#1/0
50	150	35-54	1 1/8	7/8	9/16	6 1/2	1 7/8	1 1/8	1/4	15/16	2-12	2	#1/0
75	250	35-54	1 1/8	7/8	9/16	6 1/2	1 7/8	1 1/8	1/4	15/16	2-12	2	#1/0
100	300	35-54	1 1/8	7/8	9/16	6 1/2	1 7/8	1 1/8	1/4	15/16	2-12	2	#1/0

NOTE
A REMOVABLE COVER WILL BE PROVIDED ON THE BUSHING POCKET ON THE 50, 75 & 100 K.V.A SINGLE PHASE & THE 150, 250 & 300 K.V.A SIZES SO THAT THE LEADS MAY BE DISCONNECTED WITHOUT REMOVING THE TOP OF THE TRANSFORMER

* APPLIES IN ALL CASES EXCEPT WHERE TERMINAL CHAMBERS ARE USED ON NETWORK TRANSFORMERS IN WHICH CASES THE 'B' DIMENSION WILL BE REDUCED TO 26 TO 47 INCHES ON 50 TO 100 K.V.A SINGLE PHASE AND 150 TO 300 K.V.A. THREE PHASE TRANSFORMER.

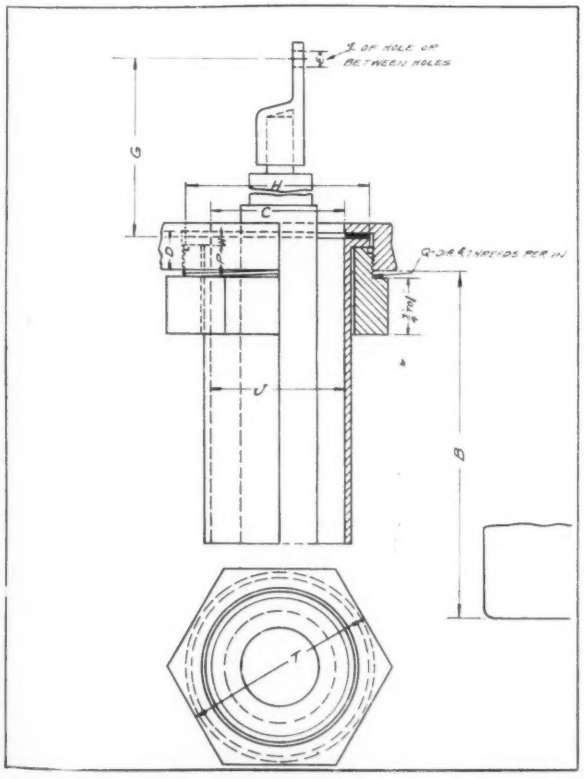

Fig. 3—Standard High and Low Voltage Cable Entrances for Network Transformers

For network transformers using single conductor cable and terminal chamber type of cable entrances.
For dimensions for low voltage bushings see Table 3.
For dimensions for high voltage bushings see Table 5.

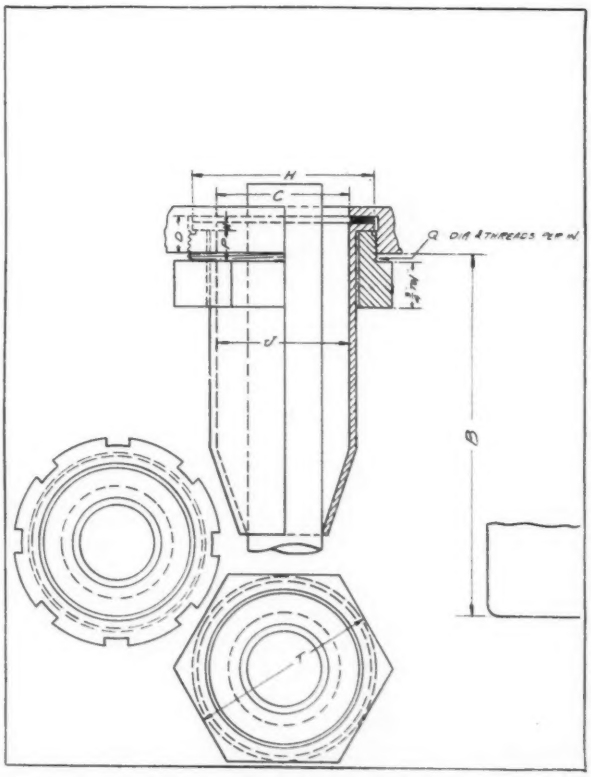

Fig. 4—Alternatives Permitted

Either a straight or tapered wiping sleeve may be provided.
Either a hexagonal or castellated type of nut for use with spanner type of wrench may be provided.

and Tables 1 and 2. Figure 1 covers the design for single-phase transformers from 5 to 37½ kv-a and three phase transformers from 15 to 100 kv-a. For this range of sizes the cable connections are made direct to the terminal board or to a lug on an extension from the terminal board provided by the manufacturer. Since the connections are made inside the transformer, it is necessary to remove the top of the transformer to disconnect the cable leads. the wiping sleeve will be straight, so that by means of a removable cover on the bushing pocket the leads can be disconnected without removing the top of the transformer. Table 4 covers the dimensions for the primary entrances.

Cable Entrances for Network Transformers

Standards for interchangeability are recommended for both primary and secondary cable entrances for network transformers as follows:

TABLE 5

STANDARD DIMENSIONS FOR SCREW TYPE HIGH VOLTAGE BUSHINGS FOR 13.2 KV. SINGLE PHASE AND THREE PHASE NETWORK TRANS USING SINGLE CONDUCTOR CABLE WHERE TERMINAL CHAMBERS ARE USED BUT GROUNDING SWITCHES ARE NOT PROVIDED SEE FIG 3.

Max O.D. of Cable	Trans Shell		Lug		Bushing			Clamp Screw		
	C	D	E	G	H	J	N	P	Q	T
1"	1⅛	⅞	2/16	9	1⅞	1⅛	¼	15/16	2-12	2
1⅛	1½	⅞	11/16	9	2⅛	1½	¼	15/16	2⅜-12	2⅜

NOTE
IN ORDERING SPECIFY WHICH "J" DIMENSION IS REQUIRED

Figure 2 covers the design for low voltage cable entrances for single-phase units of 50 kv-a and larger and three-phase units of 150 kv-a and larger. On the larger sizes of transformers the length of the cable extending within the bushing pocket, that is, the "G" dimension, is shortened so that the connection to the cable is made within the bushing pocket. By means of a removable cover to the bushing pocket, the transformer leads may be disconnected without removing the top. Table 1 shows the dimensions for the single-phase transformers and Table 2 for the three-phase transformers. Where a three-wire connection is used, all cable entrances shall be of the same size.

2. *High voltage cable entrances (primary).* In view of the fact that the use of 4 kv and 2.3 kv is practically universal for primary voltage of radial distribution systems, the interchangeability was based upon this range of voltage of primary cable. Figure 1 applies to all the sizes of primary cable entrances. However, in order to correspond with the low voltage cable entrances on 50 kv-a and larger single-phase transformers and on 150 kv-a and larger three-phase units the "G" dimension is shortened and the cable extending inside of

1. *Low voltage cable entrances (secondary).* Since the use of the terminal chamber for network transformers has become practically standard these proposals have been prepared assuming the use of the terminal chamber. Figure 3 shows the type of design. The dimensions recommended as standard are shown in Table 3. It will be noted that the standards are based upon cable size rather than transformer capacity. The reason for this is that on network systems the size of cable used for the secondary mains is usually independent of the transformer capacities used.

2. *High voltage cable entrances (primary).* If the primary voltage is 4 kv the same standards for the primary cable entrances will be used as for the standard manhole type of transformer, as covered in Figure 1 and Table 4. However, with the use of the terminal chamber, as explained in a note on Table 4, a shorter "B" dimension will be used and the cable extending inside of the wiping sleeve will be straight rather than curved, as shown in Figure 1. For 13.2 kv cable entrances, the size of the bushing or wiping sleeve will be based upon the outside diameter of the cable, as shown in Figure 3 and Table 5.

Alternatives Permitted

In adopting the designs included in this report, the following alternative methods of construction, as shown in figure 4, are open to the manufacturing companies at their discretion or upon request of the purchaser:

1. Either a hexagonal nut or a castellated nut can be used for clamping the wiping sleeve onto the transformer case. The castellated clamping nut has the advantage that it can be used with a spanner wrench.

2. Either a straight or tapered wiping sleeve may be provided.

Iowa Sales and Distribution Meeting

The 1934 Sales and Distribution School of the Iowa Public Utilities Association was held at the Russell-Lamson Hotel, Waterloo, Iowa, on January 22-23. A joint session of both groups was held during the forenoon and afternoon on January 22, with separate meetings being held on the following day.

This meeting was well attended with interesting discussions of utility problems being given at the first general session by B. J. Price, president of the Iowa Public Service Company; Arthur Huntington, of the Iowa Electric Company, and Frank R. Innes, Western editor of the *Electrical World*. The second general session was devoted to a paper on the Effect of Range Loads on Demand, Consumption and Revenue, and to a discussion on better lighting and residence illumination.

Numerous exhibits of line materials, appliances and illumination equipment were placed on display by electrical supply companies and jobbers.

Committee on Statistics and Accounts, N.A.R.U.C.

The National Association of Railroad and Utilities Commissioners has announced that the personnel of its Committee on Statistics and Accounts of Public Utility Companies for the ensuing year is as follows: Chairman, Milo R. Maltbie, New York; W. M. Hammond, Illinois; L. R. Bitney, Minnesota; B. Frank Morgan, Pennsylvania; John H. Bickley, Wisconsin; Riley E. Elgen, Dist. of Col.; Everett E. Stone, Massachusetts; Charles F. Martin, North Dakota, and Albert E. Lamb, Maine.

STATUS OF METER MOUNTING DEVELOPMENT

One of the most timely and important subjects now being studied by the Electrical Equipment Committee is the problem of customer meter mountings, for two leading reasons:

(1) The need for better control of energy diversion
(2) Economies that may be realized in meter installation and operation

Recognizing the importance of the situation, the Edison Electric Institute has, under the auspices of the Electrical Equipment Committee, two subcommittees, one on "Meter Mounting" and one on "Energy Diversion" working together to find a satisfactory solution to these problems.

With upwards of twenty million house service meters in use today, it is not difficult to appreciate the very real money savings if all these meters had been made for one simple interchangeable method of mounting, affecting not only installation cost but subsequent costs of maintenance and reconnections. Such interchangeability might be compared to the incandescent lamp, which, as is well known, started out with a variety of mountings without interchangeability.

So far as meters now in service are concerned, much of this opportunity for savings is lost or deferred. However, with the movement for conversion to the outdoor location, which is being accelerated, and for new meters to be purchased, there remains opportunity for a worth while saving if a simple standard of interchangeability for all makes of meters can be worked out and put into effect. This is the problem which the subcommittee has tackled.

Simplification and interchangeability of mounting has progressed slowly due to diverse practices among power companies in purchasing and installing meters, but the committee believes that if an agreement in principle as to needs can be arrived at among the power companies, it will be quite possible to work out with the manufacturers a generally satisfactory single standard for the mounting of house meters.

A standard such as proposed for new work and for reinstallations, of course, will mean at the start more or less inconvenience to every company because of the present diverse refinements and practices of mountings. However, the opinion seems to be general that this movement is worthy and that the benefits to be realized will soon outweigh inconveniences incidental to the putting in effect of such a unification of practice.

The Subcommittee on Meter Mountings has now reached the stage of needing the constructive criticism and advice of the men on the properties who have to deal with this problem in a broad minded way. The following recent report to members of the Electrical Equipment Committee by O. K. Coleman (of the American Gas and Electric Company), Chairman Meter Mounting Subcommittee, presents the subcommittee's analysis of the situation, submits a draft of principles of power company needs and requests from the members a definite answer to certain fundamental questions.

SUBCOMMITTEE REPORT

The Meter Mounting Subcommittee has been active for several months. Meetings have been held and the subcommittee members are in agreement as to the work to be done, and the procedure. They feel that a new standard meter mounting is necessary. The work of the subcommittee has reached the point of requiring representative advice from the operating companies.

In order to carry forward this work it is absolutely necessary to have a thorough agreement on principle and a definite policy before making any attempt to proceed with the details of developing a standard meter mounting. The development of such standards in the past has always been complicated due to the attempt to handle details in a large committee. It was therefore the intention to overcome this by getting the industry to agree on the principles involved and then leaving the details to be worked out by a small committee, such as has been set up.

The meters being used today, as far as mounting is concerned, have been standardized to a certain extent. This was arrived at only after about 35 or 40 years' experience, or from the beginning of the industry up to about 4 or 5 years ago. These meters are standard in that the same rating of meter of different manufacturers will fit into the same trim. Having thus finally arrived at such a standardization of mounting, it might be asked why it is necessary to open the discussion at this time. Changing conditions have necessitated this. There are two changes, both comparatively recent, which make a change in mounting desirable. The original meters were made for open wiring. With the adoption of enclosed wiring, the wiring was adapted to the meter by providing a hole in a box or a fitting that would permit the open wire terminal of the meter to be inserted. The two changes mentioned above which make this method of installation impractical are—

(1) A change in the sequence in reference to the relative location of meter switch and fuses. Whereas the old practice was to install the meter on the load or customer's side of the service switch and fuses, the new practice, in order to eliminate or discourage diversion of energy and to simplify customers' equipment, is to put the meter on the service or line side of the switch and fuses. To do this some additional box or outlet must necessarily be provided.
(2) The growing popularity of outside meters makes a new standard desirable. Probably the most important reason for the outside meter is to discourage diversion of energy, but there are also a number of other advantages, such as lower cost service wiring to the customer, lower reading cost, elimination of skip readings and estimated bills, and avoidance of the nuisance to the customer of admitting meter readers.

To meet these new conditions practically every operating company has developed some type of make-shift box or enclosure for installing the meter ahead of customer's equipment either indoors or outdoors. The manufacturers, too, have been busy and two different general ideas or methods have been developed. One of these follows from the development of a detachable meter. The meter housings have recently been redesigned so that all manufacturers' meters could be adapted to, or be interchangeable with this or a housing of equivalent dimensions. The other general line of development contemplates mounting to accommodate several different types of bases, some for indoors, some for outdoors and some for both, all interchangeable.

Such diversified development will undoubtedly be expensive both to the users and to the manufacturers. The problem from a broad viewpoint is therefore clear; it is to work out of this maze of developments one device or piece of equipment on which all can standardize and on which all can concentrate their efforts. To give some

(Continued on page 61)

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For Papers on Subjects Relating to the Electric Light and Power Industry

BYLLESBY PRIZE . . *Accounting*

Cash prizes of $100, $50 and $25 donated by Byllesby Engineering and Management Corporation, in memory of Colonel H. M. Byllesby, for the three most meritorious papers showing How to Increase the Usefulness of the Accountant in the Electric Light and Power Industry.

FORBES PRIZE . . *Public Relations*

A cash award of $250 donated by Mr. B. C. Forbes, Editor, Forbes Magazine, for the most meritorious paper dealing with the subject of Public Relations in the Electric Light and Power Industry.

LINDEMANN PRIZE . . *Electric Cookery*

Cash prizes of $150, $100 and $50 donated by Mr. A. L. Lindemann, Vice President and General Manager, A. J. Lindemann and Hoverson Company, for the three most meritorious papers dealing with the Advantages of Electric Cookery for Domestic Purposes.

McGRAW PRIZE . . *Engineering*

Cash prizes of $250, $150 and $100 donated by Mr. James H. McGraw, Chairman of Board, McGraw-Hill Publishing Company, for the three most meritorious papers on any Engineering or Technical subject relating to the Electric Light and Power Industry.

RULES AND CONDITIONS OF CONTESTS FOR PRIZES TO INDIVIDUALS

Any person employed by a company having membership in the Edison Electric Institute is eligible to enter the competition. No person is eligible to win two years in succession the identical prize or lower prize of the same award, but is eligible for a higher prize of that award. Papers must be the original work of the author or authors, prepared exclusively for this competition. Papers may be of any length, and pen-and-ink drawings or photographs suitable for reproduction may be included. Papers should be typewritten on one side only.

Papers will not be returned to contestants, but will become the property of the Edison Electric Institute and will be available for inspection at the General Offices of the Institute. The right is reserved to publish any paper entered in the contest.

The first page of the manuscript must give the following information: the name of the prize for which the paper is submitted, title of paper, name of author, name and address of employing company, title or character of position and home address. One paper may not be submitted for more than one prize.

PRIZES TO COMPANIES AND INDIVIDUALS

For Accomplishments in Specified Activities

CHARLES A. COFFIN AWARD

Sponsored by the General Electric Company

A Gold Medal, known as the Charles A. Coffin Medal, will be awarded to the public utility operating company within the United States which, during the year 1933, has made a distinguished contribution to the development of electric light and power for the convenience and well-being of the public and the benefit of the industry. The company awarded the medal will also receive $1,000 for its employes' benefit or similar fund.

An invitation to all electric light and power companies in the United States to make presentations of their accomplishments during 1933 was extended in October 1933.

Complete details and registration forms for the Charles A. Coffin Award may be secured from the Secretary, Edison Electric Institute, 420 Lexington Avenue, New York, N. Y.

HUGHES AWARD

Domestic Electric Cookery Load

A cup donated by Mr. George A. Hughes, President, Edison General Electric Appliance Company, Inc., to the Company Member* of the Edison Electric Institute showing the greatest contribution to the development of the Domestic Electric Cookery Load, through promotion, or selling, or both, during the fifteen-month period, January 1, 1933, to March 31, 1934, and cash prizes totaling $1,000 to the individuals responsible for the achievement.

All entries for the Hughes Award must be forwarded by April 15, 1934, to the Secretary, Edison Electric Institute, 420 Lexington Avenue, New York, N. Y.

*All electric light and power companies which registered up to May 15, 1933, and company members of the Edison Electric Institute which registered on or before July 25, 1933, are eligible for the contest terminating on April 1, 1934.

MARTIN AWARD

Rural Electrification

A bronze plaque donated by Mr. Thomas W. Martin, President, Alabama Power Company, to the Company Member of the Edison Electric Institute showing the greatest contribution to the advancement of Rural Electrification (agricultural advancement within the company's territory due to uses of electricity, development of rural load, cooperation with other agencies, extension of rural lines, organization and plan for conducting rural electric development) during the calendar year 1933.

Complete details and registration forms for the Martin Award may be secured from the Commercial Department, Edison Electric Institute, 420 Lexington Avenue, New York, N. Y.

Elaborate and costly exhibits are entirely unnecessary. The merit of an enterprise presented in papers or exhibits will be the prime factor in determining awards, without regard to the size of competing companies.

Papers and exhibits for 1934 prizes must be forwarded by April 1, 1934, except as otherwise stipulated, to the Secretary, Edison Electric Institute, 420 Lexington Avenue, New York, N. Y.

Winners will be announced and prizes awarded at the 1934 Convention of the Edison Electric Institute

PRIZE AWARDS COMMITTEE: George B. Cortelyou, James E. Davidson, Frank W. Smith, *Chairman*

Gilchrist Prize Paper

PROMOTION OF ELECTRICAL ADVERTISING*

Sioux City is the capital of the world's richest agricultural empire—advantageously located at the junction of three great states: Iowa, South Dakota and Nebraska, and at the point where the Big Sioux and Floyd rivers and Perry Creek empty into the Missouri River. It is the shopping center of four states, drawing its retail trade from northwest Iowa, southwestern Minnesota, southeastern South Dakota and northeastern Nebraska.

As the slogan implies—"Home Market for the Great Northwest"—it is one of the major marketing centers of the great Middle-West, where the Industrial East meets the Agricultural West.

Sioux City is Iowa's foremost industrial center, leading the Hawkeye state in manufacturing, jobbing, meat packing, live stock, grain and milling, dairy and produce marketing, bee keeping and honey marketing, as a retail center, and as a rail and power center.

Sioux City is located 509 miles west of Chicago in Woodbury County in northwest Iowa, approximately 359 miles southwest of the Twin Cities and 100 miles north of Omaha, Neb.

The area of Sioux City is 45 square miles, ranking among the largest cities of the United States in size. Its altitude is 1158 ft. above sea level.

Conservative estimates of the population residing within the corporate limits of Sioux City is 86,000. Contiguous suburbs making up the Greater Sioux City swell the population to 91,000 inhabitants. This includes the towns of South Sioux City, Neb., and Stevens, S. D. Sioux City is the second largest metropolis in Iowa, being surpassed in size only by the capital city of the state.

The Sioux City Gas & Electric Company

The Sioux City Gas & Electric Company and its affiliated companies form the largest public utility group in Iowa, furnishing electric, gas, steam heat, and street railway service.

The illumination department is responsible for the promotion of electrical advertising, sign maintenance, and sign week activities. These activities are outlined in this presentation.

Company's Advertising Display

The photograph, Fig. 1, shows the display used on the main office building of the Company in Sioux City, Iowa.

This display has been in use nightly since its installation on Dec. 20, 1928, as a monument to electrical advertising.

It was designed for the purpose of demonstrating to local merchants the various possibilities in the electrical advertising field, containing over three thousand (3000) lamps of various sizes and types, and two Neon ornamental designs. The total connected load of the display is 49 kw.

The essential features of electrical advertising are embodied in this display, namely: legibility, brightness, motion, originality, beauty, color, border, picture, size, position and maintenance facilities—an essential often neglected. The photograph shows the ladders and

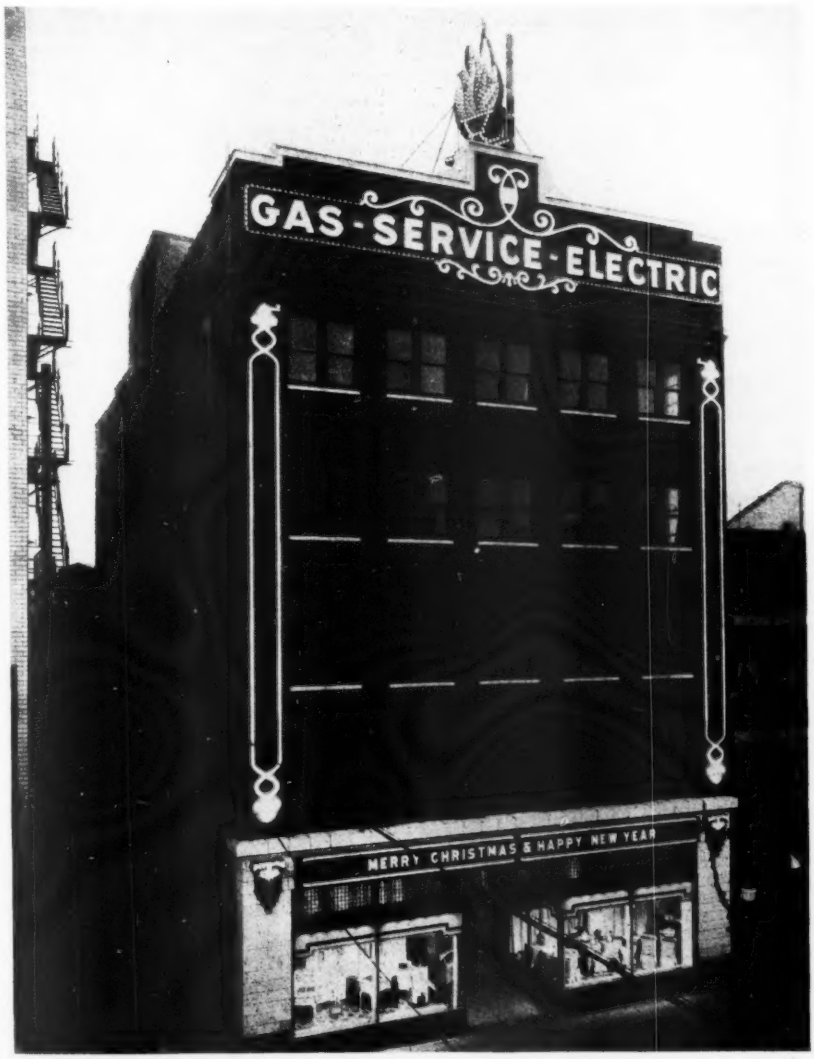
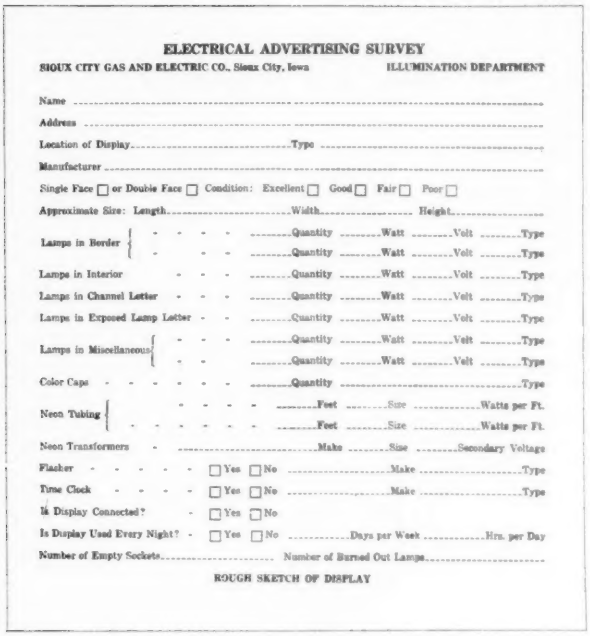


Fig. 1—Electrical Advertising on Main Office Building, Sioux City Gas & Electric Company

*For this presentation of accomplishments in the promotion of electrical advertising the 1933 James M. Gilchrist award was made to the Sioux City, Iowa, Gas & Electric Company. Cash award to Mr. C. R. Tracy, Illuminating Engineer of the company. (Supporting data and exhibits abridged for publication.)



ELECTRICAL ADVERTISING SURVEY

SIOUX CITY GAS AND ELECTRIC CO., Sioux City, Iowa — ILLUMINATION DEPARTMENT

Name .....

Address .....

Location of Display ..... Type .....

Manufacturer .....

Single Face ☐ or Double Face ☐ Condition: Excellent ☐ Good ☐ Fair ☐ Poor ☐

Approximate Size: Length ..... Width ..... Height .....

Lamps in Border { - - - - ..... Quantity ..... Watt ..... Volt ..... Type
{ - - - - ..... Quantity ..... Watt ..... Volt ..... Type

Lamps in Interior - - - ..... Quantity ..... Watt ..... Volt ..... Type

Lamps in Channel Letter - - - ..... Quantity ..... Watt ..... Volt ..... Type

Lamps in Exposed Lamp Letter - - ..... Quantity ..... Watt ..... Volt ..... Type

Lamps in Miscellaneous { - - - ..... Quantity ..... Watt ..... Volt ..... Type
{ - - ..... Quantity ..... Watt ..... Volt ..... Type

Color Caps - - - - - - ..... Quantity ..... Type

Neon Tubing { - - - - - ..... Feet ..... Size ..... Watts per Ft.
{ - - - - - - ..... Feet ..... Size ..... Watts per Ft.

Neon Transformers - ..... Make ..... Size ..... Secondary Voltage

Flasher - - - - - ☐ Yes ☐ No ..... Make ..... Type

Time Clock - - - - ☐ Yes ☐ No ..... Make ..... Type

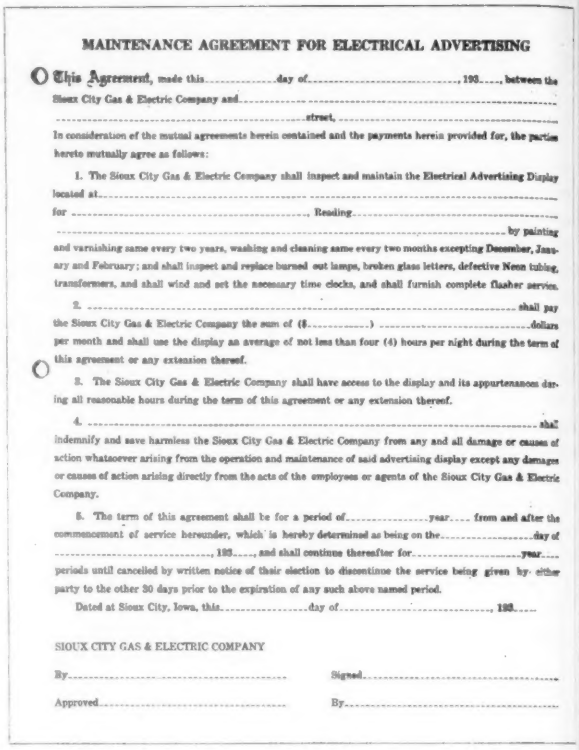
Is Display Connected? - ☐ Yes ☐ No

Is Display Used Every Night? - ☐ Yes ☐ No ..... Days per Week ..... Hrs. per Day

Number of Empty Sockets ..... Number of Burned Out Lamps .....

ROUGH SKETCH OF DISPLAY

Fig. 2 (above) Survey Sheet



MAINTENANCE AGREEMENT FOR ELECTRICAL ADVERTISING

This Agreement, made this ..... day of ..... 193..., between the Sioux City Gas & Electric Company and .....
..... street,

In consideration of the mutual agreements herein contained and the payments herein provided for, the parties hereto mutually agree as follows:

1. The Sioux City Gas & Electric Company shall inspect and maintain the Electrical Advertising Display located at .....
for ..... Reading .....
..... by painting and varnishing same every two years, washing and cleaning same every two months excepting December, January and February; and shall inspect and replace burned out lamps, broken glass letters, defective Neon tubing, transformers, and shall wind and set the necessary time clocks, and shall furnish complete flasher service.

2. ..... shall pay the Sioux City Gas & Electric Company the sum of ($.....) ..... dollars per month and shall use the display an average of not less than four (4) hours per night during the term of this agreement or any extension thereof.

3. The Sioux City Gas & Electric Company shall have access to the display and its appurtenances during all reasonable hours during the term of this agreement or any extension thereof.

4. ..... shall indemnify and save harmless the Sioux City Gas & Electric Company from any and all damage or causes of action whatsoever arising from the operation and maintenance of said advertising display except any damages or causes of action arising directly from the acts of the employees or agents of the Sioux City Gas & Electric Company.

5. The term of this agreement shall be for a period of ..... year..... from and after the commencement of service hereunder, which is hereby determined as being on the ..... day of ....., 193....., and shall continue thereafter for ..... year..... periods until cancelled by written notice of their election to discontinue the service being given by either party to the other 30 days prior to the expiration of any such above named period.

Dated at Sioux City, Iowa, this ..... day of ..... 193.....

SIOUX CITY GAS & ELECTRIC COMPANY

By ..... Signed .....

Approved ..... By .....

Fig. 4 (right) Maintenance Agreement

foot rail equipment for simplifying maintenance.

Changeable copy is used in a portion of the display to feature slogans and company advertising.

Electrical Advertising Survey

An electrical advertising survey is very important for the establishment of the maintenance program.

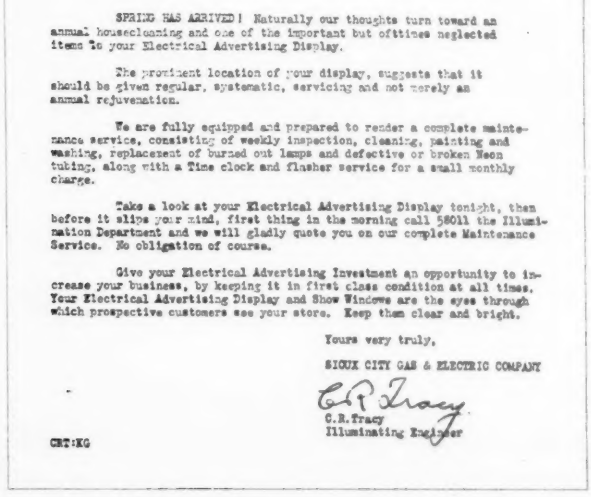
A survey made in 1928 previous to the inauguration of our maintenance program revealed a total of 482 displays installed of which the largest percentage were in need of attention, 20 per cent were not used regularly, while 2 per cent were not even connected. A few of them had not been used for four or five years. Empty sockets and burned out lamps averaged about 100 watts per sign.

These facts are only obtainable from a survey of this nature. The survey sheet, Fig. 2, is self-explanatory.

Maintenance Program

In the absence of an organized maintenance company it behooves the utility to inaugurate this type of service.

Maintenance is a valuable asset to both the merchant and the utility. From the merchant's viewpoint it assures him of having his display kept in first-class condition throughout the year, and it insures the utility of the revenue which it is justly entitled to, of the prompt replacement of burned out lamps and



SPRING HAS ARRIVED! Naturally our thoughts turn toward an annual housecleaning and one of the important but oftimes neglected items is your Electrical Advertising Display.

The prominent location of your display, suggests that it should be given regular, systematic, servicing and not merely an annual rejuvenation.

We are fully equipped and prepared to render a complete maintenance service, consisting of weekly inspection, cleaning, painting and washing, replacement of burned out lamps and defective or broken Neon tubing, along with a Time clock and flasher service for a small monthly charge.

Take a look at your Electrical Advertising Display tonight, then before it slips your mind, first thing in the morning call 58011 the Illumination Department and we will gladly quote you on our complete Maintenance Service. No obligation of course.

Give your Electrical Advertising Investment an opportunity to increase your business, by keeping it in first class condition at all times. Your Electrical Advertising Display and Show Windows are the eyes through which prospective customers see your store. Keep them clear and bright.

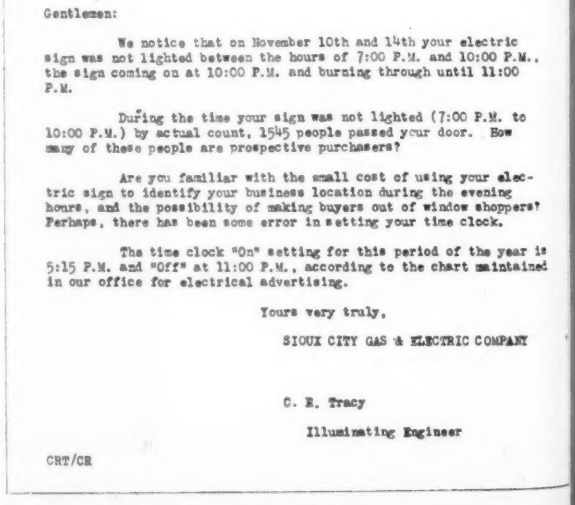
Yours very truly,

SIOUX CITY GAS & ELECTRIC COMPANY

C.R. Tracy

C.R.Tracy
Illuminating Engineer

CRT:KG



Gentlemen:

We notice that on November 10th and 14th your electric sign was not lighted between the hours of 7:00 P.M. and 10:00 P.M., the sign coming on at 10:00 P.M. and burning through until 11:00 P.M.

During the time your sign was not lighted (7:00 P.M. to 10:00 P.M.) by actual count, 1545 people passed your door. How many of these people are prospective purchasers?

Are you familiar with the small cost of using your electric sign to identify your business location during the evening hours, and the possibility of making buyers out of window shoppers? Perhaps, there has been some error in setting your time clock.

The time clock "On" setting for this period of the year is 5:15 P.M. and "Off" at 11:00 P.M., according to the chart maintained in our office for electrical advertising.

Yours very truly,

SIOUX CITY GAS & ELECTRIC COMPANY

C. R. Tracy

Illuminating Engineer

CRT/CR

Figs. 3A and 3B—Specimen of letters soliciting use of Maintenance Service

broken or defective Neon tubing, as well as the assurance that the display will be used every night.

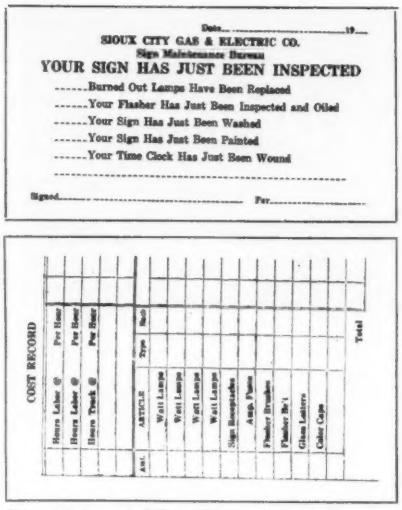
The names and addresses of the merchants obtained from the survey make up the maintenance suspect or mailing list. Agreements are solicited through the use of direct mail in the form of personalized letters mailed about every two months to the owners of electrical advertising displays. (Two specimens of letters used are shown in Figs. 3A and 3B.) Each mailing produces inquiries from the merchants showing interest in our maintenance service and a prompt follow-up of the inquiry results in successfully obtaining the maintenance agreement (Fig. 4).

The information obtained from the survey is used for estimating the monthly maintenance service charge and facilitates closing the transaction in one call.

The service rendered under our maintenance agreement consists of: painting and varnishing of the entire display once every two years, washing and cleaning every two months except December, January and February, furnishing and replacement of burned out lamps, broken or defective Neon tubing and transformers, weekly inspection and winding and setting of time clocks to compensate for the shortening and lengthening of the days throughout the year, based on a predetermined schedule for the "on" setting of the time clock. This schedule provides a total of 1535 burning hours throughout the year. The merchant agrees to use the display an average of four hours per day during the term of the maintenance agreement. The time clock schedule based on the total hours averages 4.2 hours per day.

The weekly setting of the time clock proved to be a good selling point for maintenance service. Attention of the merchant is called to the fact that a considerable saving may be effected through a systematic weekly change of the time clock "on" setting. The merchant is inclined to change the setting about once in a couple of months and their negligence in winding the time clock results in the sign not being lighted or if lighted, not turning off properly. We have found the time clock feature an asset to our maintenance service.

To insure the merchant's knowledge that he is receiving regular and adequate service, a system of inspection tickets, Fig. 5A, are used by the maintenance men; each time an inspection


Date..... 19....
SIOUX CITY GAS & ELECTRIC CO.
Sign Maintenance Bureau
YOUR SIGN HAS JUST BEEN INSPECTED
.....Burned Out Lamps Have Been Replaced
.....Your Flasher Has Just Been Inspected and Oiled
.....Your Sign Has Just Been Washed
.....Your Sign Has Just Been Painted
.....Your Time Clock Has Just Been Wound
.....
Signed..... Per.....
COST RECORD
Hours Labor @
Hours Labor @
Hours Truck @
Per Hour
Per Hour
Per Hour
ARTICLE
Ant.
Type
Red
Wall Lamps
Wall Lamps
Wall Lamps
Wall Lamps
Sign Receptacles
Amp. Plates
Flasher Brushes
Flasher Bd's
Glass Letters
Color Caps
Total

Figs. 5A and 5B—Obverse and Reverse Sides of Maintenance Inspection Tickets

or any work is performed on the display a notation is made on the inspection ticket, indicating the nature of the work by a check mark opposite the classification. An extra blank line is provided on the ticket for miscellaneous items. The service men are required to secure the signature of the merchant each time any work is done or an inspection made of the display.

The reverse side of the inspection ticket, Fig. 5B, is used as the cost record. Notations are made as to the hours of labor and truck time, also the number and sizes of lamps used, as well as other items which constitute a portion of the average replacements for maintenance service. The material is classified and the tickets turned in at the office each day. The costs are added by a clerk and the total amount is shown on each ticket. These costs are transcribed to another form that is kept as a permanent record. The inspection tickets are filed for future reference, in case the merchant raises a question of not having received service. These tickets are retained in the file for twelve months, after which time they are destroyed.

The permanent record cards men-

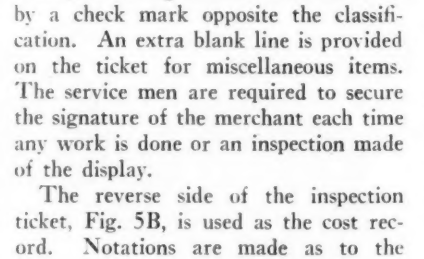

SIGN MAINTENANCE RECORD AMOUNT $
NAME DATE
ADDRESS EXPIRES
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
PAINTING
LAMPS FURNISHED
MISC.
REMARKS
© Key— A—INSPECTION C—COPY CHANGE W—WASHING L—LAMPED R—REPAIRED

Fig. 6—Permanent Record Card

tioned previously consist of three individual four by six cards. The first, Fig. 6, is used for a complete annual record of work performed on the display, including the dates, also the name and address, the amount of the monthly charge, the date of the agreement and the expiration date. A notation is made of the date the display was painted and the number of lamps required for the initial filling.

An unruled buff-colored card is used for keeping a month-to-month record of the costs of the individual display. These costs are divided into two classifications, labor and material. The total cost is carried forward from month to month, so it is possible at a glance to determine the actual amount of labor and material spent on any given display.

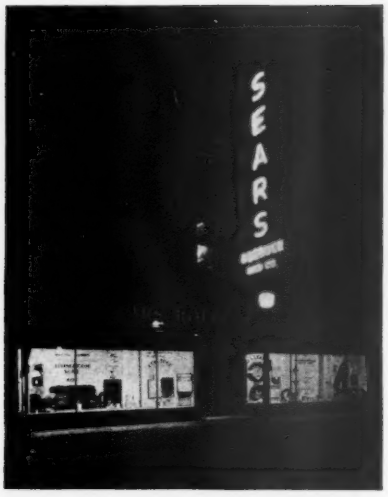
A salmon-colored card is used for recording the date and number of times the display has been washed. This card is kept in a monthly index and when the washing record is noted on the card it is set ahead two months so that it automatically appears when the next washing period is due. It is the duty of the clerk to make a list of the displays the first of each month that are scheduled for washing. This record is given to the maintenance crew for completion of the work and the returned signed inspection tickets reveal the information that the display has been washed.

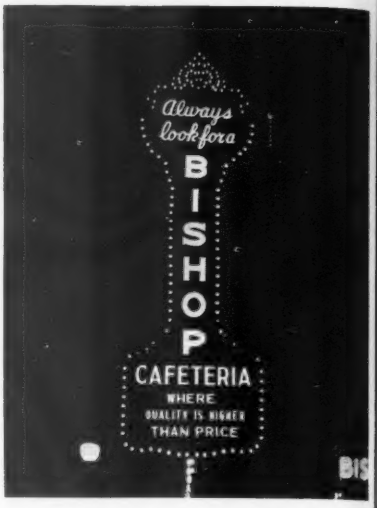
The monthly charge is figured from the information contained on the survey sheet and is based on the following: the cost of painting and varnishing the display—this portion of the work is let for contract to sign painting organizations; plus one and one-quarter filling of lamps at list price and Neon tubing replacements—(an insurance policy is taken out covering Neon tubing breakage and the cost of the policy is used in computing the maintenance charge).

To the above items is added the cost of washing which is figured at twenty cents per square foot of area of the display.

One-fourth of an hour of labor is used as a figure for winding and setting the time clocks. Twenty per cent is added to the total of the above items for miscellaneous replacements, consisting of: flasher brushes, Neon transformers, defective Neon tubing, broken glass letters and any other contingencies that may arise.

The sum total is the yearly maintenance cost of the individual display and this is divided into twelve equal amounts, thereby arriving at the month-





Figs. 7, 8 and 9—Typical Examples of Display Installations

ly charge which is billed to the customer in advance.

Installation of Displays

Figures 7, 8 and 9 are typical of some of the displays installed during 1932.

We have found it advantageous to provide facilities for installing displays along with our maintenance program, and we have been successful in securing the installation contract for most of the large displays installed in Sioux City, owing to the reliability of our company and the modern facilities for this type of work.

Among the installations made are the following:

Montgomery-Ward & Company
Sears Roebuck & Company
Bishop Cafeteria
Ryal Miller Chevrolet Company

And numerous other smaller jobs.

Advertising and Publicity

The newspaper advertisement, Fig. 10, is an example of the type of display space used in the local newspapers and is descriptive of displays sold and installed through our cooperative efforts with one of the larger companies.

A sixteen millimeter film showing our sign maintenance and installation work, and also our 1932 National Sign Week show window displays, has been made. It is used at meetings of merchants, clubs, and conventions for publicity purposes. It is our intention to add to this film so as to eventually have a complete story of about 800 feet in length.

National Sign Week Activity

National Sign Week was observed in 1932 by the company, through the cooperation of various manufacturers. This was the fourth consecutive year that the company has tied in with the National Sign Week activity through the use of exhibits and window displays.

We dedicated the period to the users of electrical advertising, the merchants of Sioux City, who have helped improve the appearances of the business section through the use of appropriate signs.

The following letter to the mer-

DRUGS
Tollen
PRESCRIPTIONS
Cafe-Grill
WONDERFUL FOOD
BISHOP
CAFETERIA
HOW MUCH
Is Your Name Worth?
When You Buy A
NEON SIGN
THINK of ADVERTISING VALUE FIRST
THE MOST PROFITABLE WAY IS TO BUY
SIGNS that are so STRIKING
So well-designed for your purpose that they attract attention, create favorable impressions and a positive identification OF YOUR LOCATION AND YOUR BUSINESS
We have the experience and the facilities for the design and construction of distinctive NEON and ELECTRIC DISPLAYS of every description—Made in Sioux City. Without obligation we will submit suggestions and prices.
General Outdoor Advertising Co.
1723 Geneva Street
Sioux City, Iowa
Phone 5-4160
CALL
TERMINAL
INSURANCE
EXCHANGE
BLDG.

Fig. 10—Example of advertisements used in local newspapers

chants was mailed out a week in advance of Sign Week:

"During the week of March 14 to 19, 1932, the Seventh Annual National Sign Week will be observed throughout the country. This year the entire week will be dedicated to the users of electrical advertising—the merchants of Sioux City who have done much toward making the streets of Sioux City extremely attractive by using electrical display advertising.

"During the week of March 14 to 19 our company will inspect your display and replace burned out or defective lamps and thoroughly wash and clean your sign without extra cost over and above the list price of the lamps used, as our contribution to you in observance of this event.

"Write or phone 58011, Sign Maintenance Department, for this service."

The response received from this offer was beyond our expectations, our maintenance men were kept busy for almost two weeks, washing and relamping displays.

Invitations were mailed to our entire list of commercial accounts, calling attention to our window displays and we believe that every merchant in our city viewed the displays. The text of this invitation read:

"You are invited to inspect the show window display at our office, 515 Fifth Street, any day or evening, between March 14 to 26, 1932.

"Introducing the latest developments in the field of Electrical Advertising:

Animated Neon Displays
Silhouette Letter
Combination Lamp and Neon
Photo-Electric Cell
Massed Lamp Signs
Display Advertising
Changeable Copy
Neon Animator
Color Hoods and Flashers
Time Switches and Accessories

"Be Sure to See This Display.

"This is Seventh Annual National Sign Week."

Owing to the interest created in the display, we found it necessary to keep it in the windows for an additional week.

Both of our large show windows were used (See Fig. 11) and in order to carry out our ideas, it was necessary to build a floor and back-ground in the windows and divide them into sections, making a total of seven shadow boxes, in each of which we featured one large display, depicting a particular type of electrical advertising. Small flashing signs were used on the background as a title for each shadow box. More than 150 yards of black theatrical duvetyne were used for the sides and background.

We believe the window displays created an unusual amount of interest in electrical advertising locally; in fact, we received numerous requests for information, which were turned over to the different manufacturers for follow-up.*

*An article, "How We Promote National Sign Week" by C. R. Tracy, Illuminating Engineer, Sioux City Gas & Electric Company published in the February, 1933, issue of *Signs of the Times* describes the displays.

CONFERENCE OF ELECTRIC LIGHT AND POWER GROUP REPRESENTATIVES ON ELECTRICAL COMMITTEE N F P A

A conference of the representatives of the Electric Light and Power Group on the Electrical Committee, National Fire Protection Association, was held at the general office of the Institute, on January 24. Various rules of the 1933 edition of the National Electrical Code were discussed and consideration was given to the alleged effect on water supply of the grounding of utilization circuits to water piping systems. Several newspaper articles have appeared within the last few weeks which obviously were intended to warn water companies of the possibilities of water contamination due to pipes carrying electric current, but these appear to be greatly exaggerated when judged upon the meager data and information available. The detrimental effects mentioned are said, under certain conditions, to result in discoloring the water and giving to it an objectionable taste and odor. It was decided to recommend that the E.E.I. endeavor to determine the facts and consider the desirability of the formation of a joint committee to work with representatives of the American Water Works Association and other interested groups.

Another important matter considered was the preparation of standards for wiring materials and appliances for submission to the American Standards Association for approval as American Standards. Such standards have formerly been made by the Underwriters' Laboratories of the National Board of Fire Underwriters and it was felt that the time has come when manufacturers and users should be represented in the preparation of such standards. The conference approved basic principles to be used as a guide in a discussion at an industry conference which is to be held soon for the purpose of discussing arrangements whereby such standards will be prepared in the future by a group consisting of a broader representation.

Several other Electrical Code matters, including bare neutral wiring and current theft, were discussed.

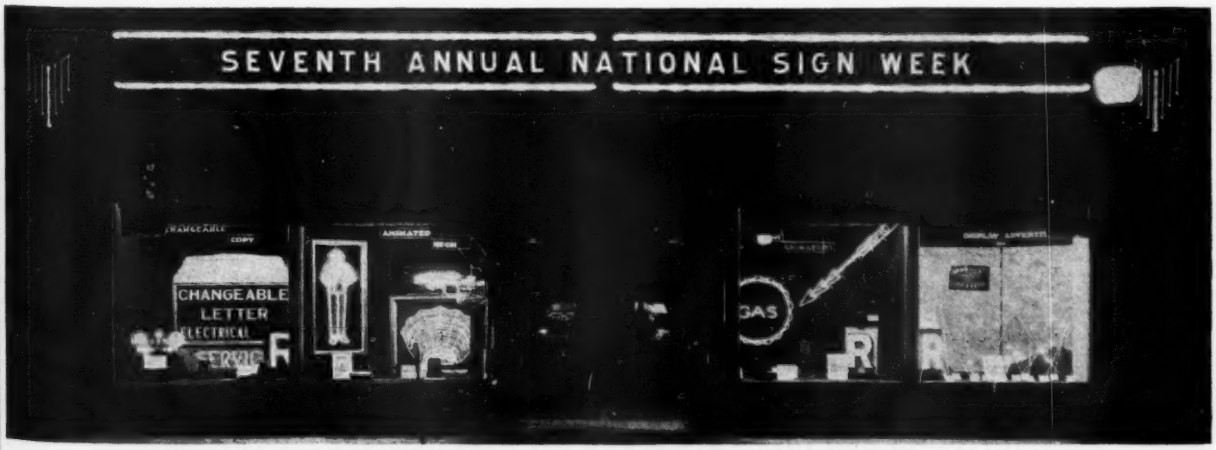


Fig. 11—Window Display at Main Office Building During National Sign Week

POWER SYSTEM IMPEDANCES AT HARMONIC FREQUENCIES

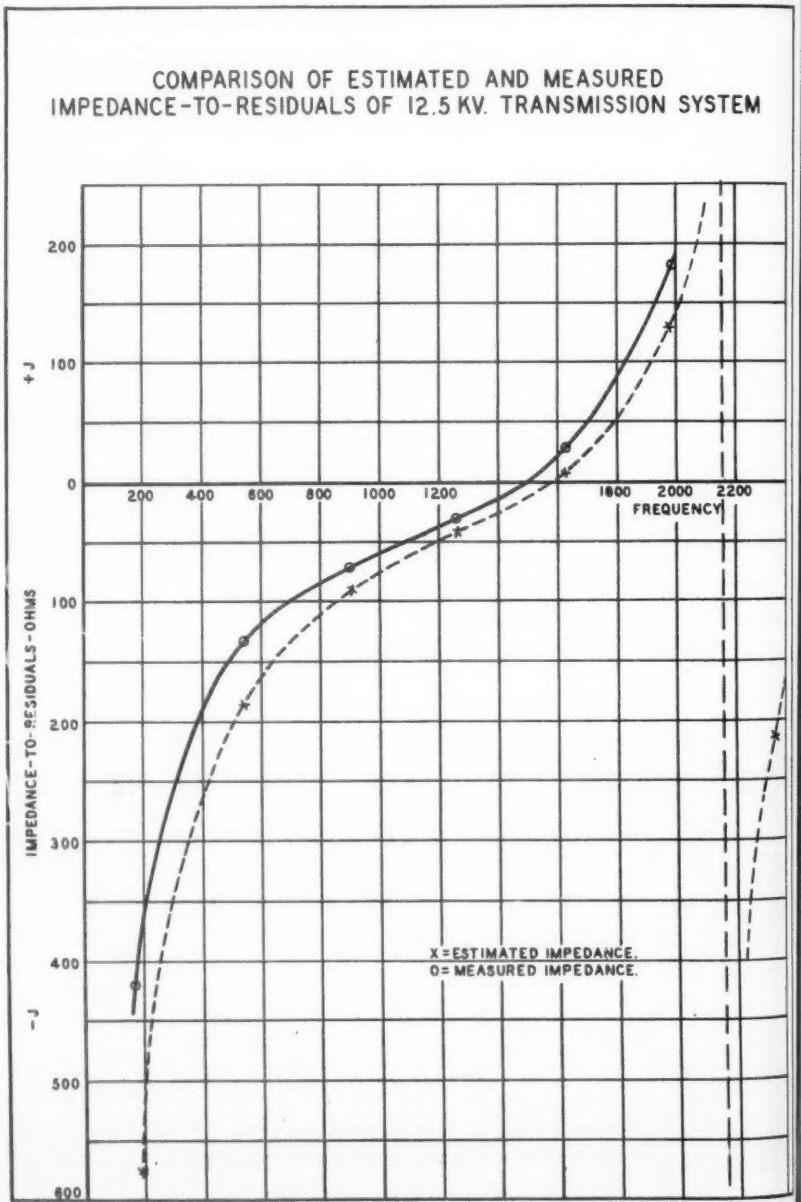
During the past year, two of the reports prepared by the Joint Sub-committee on Development and Research have dealt with the impedances of power systems at harmonic frequencies. The titles of these reports are "The Impedances of A-C Supply Systems at Harmonic Frequencies to Balanced Components," and "The Impedances of A-C Supply Systems at Harmonic Frequencies to Residual Components." These impedances are often required in connection with studies of noise frequency induction problems. For example, in making estimates of the effect of mercury arc rectifiers on the wave shape of the A-C supply circuit it is essential to know the impedances of the supply circuit to balanced components at various harmonic frequencies of interest. Similarly, to determine the effect of residual voltages such as, for example, triple harmonic voltages arising in a generator operating with grounded neutral it is necessary to know the impedance to residual components of the system to which it is connected. In preliminary estimates of such situations as these, measured values of impedances are rarely available, and consequently methods of estimating them, such as are described in these reports, are very helpful.

The system impedances through which the balanced harmonic components regulate are the phase-to-phase or phase-to-neutral impedances. As a matter of convenience use has been made of the equivalent phase to neutral circuit in the report dealing with balanced components. For the residual components the impedance obtained by the methods given in the report is that of the circuit consisting of the three line conductors in parallel with return in the earth and grounded or neutral conductors.

In making calculations of system impedance it was found convenient to build up a composite equivalent circuit made up of elements representing the impedances of the lines and of the various pieces of connected equipment. In this equivalent circuit overhead transmission lines or cable circuits can be approximately represented by networks of inductive and capacitive reactances, and equipment such as transformers, reactors, regulators and rotating machinery can be represented by inductive reactances. Methods of calculating these equivalent impedances for the various component parts of a power system are described in detail in the reports, and summaries of the necessary formulas and constants are included.

One important difference between the methods given in these reports and the corresponding methods of calculating impedances at fundamental frequencies appears in connection with the determination of the impedances of overhead lines. Since frequencies up to 2000 cycles are often important in noise coordination problems, impedance calculations must be made for conditions where the electrical length of the circuits involved is large. As a consequence, it is common to find at least one, and sometimes several, points of resonance within the frequency range of interest. The accompanying figure

(Continued on page 64)



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*Prepared by Industrial Power and Heating Subcommittee of the Sales Committee, Edison Electric Institute.

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Electric Refrigerator Sales

(Continued from page 37)

winners. With two of the four classes open to dealers and the other two to central stations, the entries in these two general classifications were almost equally divided. New Jersey led all the States in the number of entries with twenty-eight.

The judges of the contest were L. H. Coloney, Carl Percy and Harvey P. Jackson, all of New York City and all men of wide experience in the field of advertising display. All of them had served many times as judges of window display contests in other merchandising lines, and it was their unanimous opinion that the quality of the exhibits in this competition was the highest they had ever seen. Their decisions were based primarily upon four points, namely, the sales appeal of the display, originality, general attractiveness and special features such as color, lighting effects, motion, etc.

The complete list of awards follows:

Dealer Windows of Less Than 100 Square Feet—First prize, $100, to Emmons-Hawkins Hardware Co., Huntington, W.Va. Second prize, $50, to Fowler Dick & Walker, Inc., Binghamton, N. Y. Honorable Mention to Zion's Cooperative Mercantile Institution, Salt Lake City, Utah; Kerr Dry Goods Co., Oklahoma City, Okla.; Kelvinator Sales Corporation, Detroit, Mich.

Dealer Windows of More Than 100 Square Feet—First prize, $100, to Tull & Gibbs, Spokane, Wash. Second prize, $50, to The Golden Rule, St. Paul, Minn. Honorable Mention to Broadway Department Store, Inc., Los Angeles, Cal.; Dalton's, Baton Rouge, La.; Powers Furniture Co., Portland, Ore.

Central Station Windows of Less Than 100 Square Feet—First prize, $100, to Consumers Power Co., Jackson, Mich. Second prize, $50, to Blackstone Valley Gas & Electric Co., Pawtucket, R. I. Honorable mention to Consumers Power Co., Flint, Mich.; New England Gas & Electric Co., Cambridge, Mass.; Kentucky Utilities Co., Richmond, Ky.

Central Station Windows of More Than 100 Square Feet—First prize, $100, to Southern Colorado Power Co., Pueblo, Colo. Second prize, $50, to Lynn Gas & Electric Co., Lynn, Mass. Honorable Mention to Utica Gas & Electric Co., Utica, N. Y.; Virginia Public Service Co., Newport News, Va.; Idaho Power Co., Twin Falls, Idaho.

PETERSBURG, VA., AWARDED SPECIAL BUREAU PRIZE

The special prize of $100 awarded to the local Electric Refrigeration Bureau having the best representation in the contest, in point of proportionate number of member contestants and quality of exhibits submitted, was won by the Electric Refrigeration Bureau of Petersburg, Va. The six entries received from the city represented 100 per cent of the dealer membership of the Bureau, and although none of them were among the prize-winners, the quality of their exhibits was such as to merit the careful consideration of the judges to the very last.

First Honorable Mention was awarded to the Electric Refrigeration Bureau of New Orleans, La., and Second Honorable Mention to the Essex County Electric Refrigeration Bureau, of Newark, N. J.

Checks covering the nine awards, aggregating $700, have already been sent to the dealer and central station winners and to W. G. Gay, chairman of the Petersburg Bureau.

Standardization of Primary Fuses and Cutouts

A joint committee has been formed, consisting of representatives of both the National Electrical Manufacturers Association and the Edison Electric Institute to deal with the standardization of primary fuses and cut-outs. The first meeting of this joint committee was held at the general offices of the Institute on January 26. Mr. L. G. Smith, of the Consolidated Gas and Electric Light and Power Company, was elected chairman, and Mr. E. G. Newton, of the General Electric Company, was elected secretary.

Each group discussed its problems in connection with this standardization work and very satisfactory progress was made toward an understanding upon which standards can be developed which will be mutually satisfactory to manufacturers and users.

Status of Meter Mounting Development

(Continued from page 51)

idea as to the present day costs, it might be well to point out that make-shift indoor boxes used by various companies range in cost from 50c to $3.00 and the outdoor make-shift enclosures from $1.50 to $4.50. The new enclosure developed for the detachable meters now cost a little less than $1.50 over and above the cost of the meter, either for indoor or outdoor use.

The following guiding principles have been adopted by the subcommittee:

1. The subcommittee agreed that, in order to proceed, it is necessary to drop the controversial question of details of specific designs and stick strictly to the broad principles involved.
2. For the benefit of member companies and manufacturers of meter equipment this subcommittee urges complete standardization of meter mountings so that meters of the different manufacturers will provide complete interchangeability. This standardization is absolutely necessary if the downward trend of meters and installation cost is to be continued.
   a. This standardized meter must necessarily be applicable to existing and new enclosed wiring installations.
   b. This meter must be adaptable to both outdoor and indoor installations.

Standardization should extend to all meter and metering equipment including polyphase meters and instrument transformers, but the subcommittee feels that the initial effort should be exerted on the large volume, the self-contained single phase meters.

The acceptance of these principles is very important and without such support it would be useless to continue the work. The response so far received is very encouraging. With full support it is believed much can be accomplished. The subcommittee has requested the opinion of each member of the Electrical Equipment Committee on the following questions:

(a) Do you subscribe to the statement of principles?
(b) Would your company, for the purpose of economy, use the ultimate standard although it differed from existing practice or ideas of a new standard?

INDUSTRIAL HEATING NEWS

Contributed by Industrial Power & Heating Committee, E.E.I.

MACARONI MANUFACTURERS USE ELECTRIC HEAT TO ADVANTAGE

Macaroni manufacturers have experienced considerable trouble with chilled dough, especially when starting their dough kneaders in the morning. The dough coming in contact with the cold casting of the kneading machine is chilled. By installing 5 kw in clamp-on heaters on the bottom of the kneading pan, one manufacturer has easily and simply overcome this difficulty. The heaters are connected to slip rings on the vertical rotating shaft of the kneader and are operated through a thermostat set at 110 or 120 deg. Fahr. as desired for this operation. The results have been very satisfactory and will probably lead to equipping other machines the same way.

Another application for the macaroni plant, and one which has replaced the steam heated jacket because of its ease of control and cleanliness, consists of heaters mounted on the head of macaroni extruders. Here again this insures proper temperature control of the dough at all times—each cylinder is equipped with a 1 kw unit.

HEATING PITCH FOR COATING CORK INSULATING BOARD

A recent electric heating application consists of portable immersion heaters which fit into shallow pans of pitch. The hot pitch is used in coating cork board for insulating building and refrigerator rooms. Each heater is rated at 2500 watts, and is equipped with two-pole double-throw switch in terminal box for dual voltage operation.

ELECTRIC HEAT IN MANUFACTURING OF NON-SHATTERABLE GLASS

A company manufacturing non-shatterable glass for automobile wind shields and windows has made an application of radiant electric heat using the upper end of infra red wave band in heating up the two pieces of plate glass, and a substance used as a binder between the plates to keep them from shattering. In this application it was particularly desirable to heat the binder to a definite temperature as it passed along a conveyor in a continuous production line. The speed of heating is very essential, requiring fast heating.

The result was the use of long parabolic reflectors made of copper sheet, chrome plated, in the focal point of which were located nichrome wire elements. One reflector was placed above the conveyor and another below perpendicular to line of travel so that the reflected heat waves are concentrated on the substance to be heated. One furnace or unit of 80 kw (the heaters are not inclosed) is in operation, and this has been so successful that an additional and larger unit will soon be placed in operation.

An interesting point is that the reflector temperature is quite low, indicating a relatively high efficiency of the device.

This radiant unit replaced steam heating. The principle might be applied to heating other substances on conveyors with satisfactory results, due to the penetrating quality of a high temperature heat ray.

TANK STORAGE

A large company manufacturing chemicals and coal by-products stores their products in outdoor tanks. During cold weather small quantities of water condense and settle in the valves often freezing and cracking the connections, resulting in the loss of the entire contents in the tank. A 500-watt strip heater will be installed on each of three tanks. These units will be thermostatically controlled to eliminate the above condition. It is estimated that this load of 1½ kv-a will use some 3000 kwhr annually.

PIPE HEATING

A company manufacturing paint, putty, and roofing cement stores the roofing cement in a large outdoor tank, from where it is transmitted through approximately 20 ft. of 3-in. pipe to the plant. In cold weather this liquid is very sluggish and much time is wasted in handling it. As a result of study and recommendations, six 500-watt strip heaters will be clamped to the pipe to heat the cement and facilitate movement. It is expected that this load of 3 kv-a will consume 2500 kwhr a year.

PACKAGE SEALING

Two baking companies have installed a total of approximately 2 kw in heating units to seal wax paper on bread. They will consume a total of 1500 kwhr a year.

Another baking company installed 1 kv-a hot plate for package sealing. The unit will consume approximately 1500 kwhr yearly.

SPACE HEATING

In many of our industrial plants, due to the new codes, the plant proper does not operate on Saturday mornings. This means that it is in some cases very uneconomical to keep steam in the boilers for the purpose of heating only a few offices that are occupied on Saturday morning. Several kilowatts in small office heaters have been sold, which will be operated Saturday mornings during the fall and spring months, when it is only necessary to take the chill from the room. Considerable economy is thereby effected in the saving of boiler plant labor and expense.

SAND HEATING

In the past, a large contracting company experienced difficulties in preventing sand for its sand blasting equipment from freezing during the winter. The sand is stored in a hopper and passes by gravity to a small opening in the bottom of the hopper. By properly placing strip heaters in the hopper, the sand will be kept dry and freezing prevented. One and one-half kv-a of heaters have been installed for this purpose.

COOKING

A doughnut machine of 4.4 kv-a capacity has been installed by the operators of a 5, 10 and 25 cent store chain and is expected to consume 4800 kwhr yearly.

A restaurant has installed a 5½ kw electric toaster and a 1½ kw waffle baker. The two units will consume 6500 kwhr annually.

WINDOW DISPLAY HEATING

Retail nut shops are confronted with the problem of keeping warm the pans in which they display various kinds of nuts in their show windows. Power salesmen worked out a plan whereby three 500-watt strip heaters could be used very satisfactorily. This load will use 1350 kwhr annually.

VULCANIZING

A prominent tire and rubber company has installed electric vulcanizers totaling 6.4 kw of load, which will consume 7000 kwhr yearly.

POWER SALES ITEMS

AIR CONDITIONING

"Conditioning Air for Steel Mill Motors," Electrical World, Nov. 25, 1933, pp. 684-86. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

"Air Conditioning for Stores, Shops, Restaurants and Offices." Address delivered to the American Society of Refrigerating Engineers, New York City, by W. C. Goodwin. Ice and Refrigeration, January, 1934, pp. 68-9. Nickerson & Collins, Publishers, 435 North Waller Avenue, Chicago, Ill. Publishers.

Discussion of unit type air conditioners; description of typical equipment and auxiliary apparatus.

ELECTRICAL INDUSTRY

"Developments in the Electrical Industry During 1933," by John Liston. General Electric Review, January, 1934, pp. 11-57. General Electric Company, Publishers, 1 River Road, Schenectady, N. Y.

The article reviews the past year in the electrical field covering its numerous phases from the generation of power and related equipment through appliances and their application.

Power, January, 1934. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

This issue summarizes the developments in the electrical industry for the year 1933 and as a whole should be of interest to power engineers.

ELECTRIC FURNACES

"Electrical Equipment for Induction Furnaces," by C. C. Levy. Electrical Engineering, January, 1934, p. 43. American Institute of Electrical Engineers, Publishers, 33 West Thirty-ninth Street, New York City.

This is a description of electrical equipment used for induction furnaces and deals with the auxiliaries required on induction furnaces. Considerable information is also given regarding their operation.

"Cast Iron and Its Production," by M. V. Healey. Electrical Engineering, January, 1934, p. 120. American Institute of Electrical Engineers, Publishers, 33 West Thirty-ninth Street, New York City.

This article contains a very good description of cast iron and the two methods used in producing it. Comparative costs of operation are given as well as the advantages which are claimed for electric melting.

"Rocking Indirect Arc Electric Furnaces," by E. L. Crosby. Electrical Engineering, January, 1934, p. 132. American Institute of Electrical Engineers, Publishers, 33 West Thirty-ninth Street, New York City.

This article deals with the rocking type of indirect arc furnaces, giving some of the features of the design, operation, temperature control and utilization of this particular type of furnace. The advantages for this type of furnace are pointed out, with particular reference to the production of cast iron.

"High Frequency Induction Furnaces." Electrical Engineering, January, 1934, p. 194. American Institute of Electrical Engineers, Publishers, 33 West Thirty-ninth Street, New York City.

This paper presents a brief outline of the theory of the electric induction furnace and the chief advantages associated with the use of induction furnaces. Commercial cost comparisons are given showing the advantages of high frequency melting equipment.

ELECTRIC HEATING

"Cutting Heating Costs," by Richard A. Free. National Engineer, January, 1934, pp. 2-5, 24. National Engineer, 1140 Lake Street, Oak Park, Ill.

This article describes the equipment, methods of operation, and records kept by the Carbide and Carbon Building, Chicago.

ELECTRIC HEAT—HOSIERY MILLS

"Electric Heat in Hosiery Manufacture." Electrical World, Dec. 16, 1933, p. 784. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

ELECTRICAL MAINTENANCE

"Electrical Maintenance at Rumford Press," by Francis A. Westbrook. Electrical World, Dec. 30, 1933, p. 850. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

ELECTRIC MOTORS

"New Equipment Available." Electrical World, December 30, 1933, p. 864. McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York City.

A new motor has been designed which is synchronous in type, totally inclosed and fan-cooled. The application of the motor is in locations where corrosive atmospheres prevail, or where motors are subject to salt water or other dampness.

ELECTRIC MOTORS—BEARINGS

"Benefits Derived from Anti-Friction Bearings," by Francis A. Westbrook. Electrical World, Dec. 9, 1933, pp. 760-761. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

LOAD FORECASTING

"Forecasting the Revival Phase of Kilowatt-Hour Consumption," by George J. Read. Electrical World, Dec. 16, 1933, pp. 780-784. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

MACHINE-TOOL CONTROL

"Room for Improvement in Machine-Tool Control," by D. K. Frost. Electrical World, Dec. 23, 1933, pp. 818-822. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

MACHINE TOOL DESIGN

"Electrical Advances the Trend in Machine Tool Design," by J. W. Harper, Electrical World, Nov. 4, 1933, pp. 596-98. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

MACHINE TOOLS

"Applying Motors Most Effectively on Machine Tools," by D. K. Frost. Electrical World, December 2, 1933, pp. 716-20. McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York City.

This article deals with the application of various types of motors to machines in various industries. The article stresses the importance of incorporating the motor in the machine itself, and coordinating the ideas of the electrical engineer with that of the designer of the machine.

"Wiring of Machine Tools Needs Attention," by D. K. Frost. Electrical World, February 3, 1934, pp. 195-97. McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York City.

Very frequently, or perhaps most frequently, the wiring on machine tools is a particularly noticeable feature because it is so conspicuous. The conduits, junction boxes and electrical fittings obtrude themselves on the attention. Usually no thought at all is given to the wiring and the final arrangement is left to the wireman's fancy. Electrical wiremen can generally be depended upon to do a good job from a safety standpoint, but not necessarily a good looking job, especially where no preliminary details have been worked out.

POWER FACTOR

"Low Peaks, Low Power Bills," by R. H. Rogers, Industrial Engineering Department, General Electric Company. Factory Management and Maintenance, January, 1934, pp. 24-26. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

A review of conditions contributing to increasing high peaks and excessive overloads which are subsequently reflected in the power bill; methods of correcting conditions which caused excessive demands are suggested for many types of typical loads and the importance of maintaining high plant power factor is stressed.

POWER SALES

"Steam Heating Service Aids Boston Edison Power Sales." Electrical World, Dec. 30, 1933, pp. 849-850. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

ROTATING MACHINERY

"Rotating Machinery Report by Standards Association." Electrical World, December 30, 1933, p. 841. McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York City.

An item of interest covering the contents in brief of the first report of the sectional committee on rotating electrical machinery which is under the auspices of the American Standards Association. The report covers standards for such equipment as direct current rotating machines, synchronous generators and motors. Induction motors in general and D. C. fractional-horsepower motors. The standards set forth in the report, when approved, will supersede the previous standards of the American Institute of Electrical Engineers covering the same subjects.

Power System Impedance

(Continued from page 58)

shows the impedance to residuals of a comparatively simple system of some 38 miles of line. This figure indicates two such resonance points—a series resonance in the vicinity of 1500 cycles, and parallel resonance in the vicinity of 2200 cycles. In the calculations of impedances these propagation effects are taken into account by applying appropriate correction factors to the calculated inductance and capacitance of the lines. These calculations are not very complicated, though they become somewhat tedious when impedance values are desired at a considerable number of frequencies for several lines.

In the case of the phase-to-neutral impedance the inductance and capacitance of overhead lines and cables are determined by the usual formulas. In the case of the impedance to residuals the effect of the resistivity and structure of the earth introduces a complicating factor. For practical purposes, however, it was found adequate to make use of the average of conditions which had been observed experimentally over the noise frequency range. The determination of the inductance to residuals is simplified by the use of charts. The calculation of the capacitance to residuals is facilitated by an interesting application of the reciprocal relation between inductance and capacitance.

Previous to the preparation of these reports an experimental investigation was made to determine the impedances of rotating machinery to both balanced and residual harmonics. It was found, in the case of the balanced components, that the fundamental frequency equivalent of the measured impedance to harmonics was approximately equal to 0.9 of the negative phase sequence reactance for turbo-generators and 0.7 for hydro-generators and synchronous condensers. The investigation also showed a good correlation between the zero phase sequence reactance and the fundamental frequency equivalent of the impedance to residuals at harmonic frequencies on a comparable basis.

The reports include a number of examples illustrating the application of the various methods of calculating impedances. Comparisons of estimated and measured impedances for several systems are also included.

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CONVENTIONS AND MEETINGS

FEBRUARY

5 Canadian Electrical Association, General Conference of Committees, Montreal, Can.
5-8 American Society of Heating and Ventilating Engineers, Hotel Biltmore, New York, N. Y.

MARCH

1-2 Missouri Valley Electrical Association, Engineering Group, President Hotel, Kansas City, Mo.
6-7 Oklahoma Utilities Association, Mayo Hotel, Tulsa, Okla.
7 American Society for Testing Materials, Washington, D. C.
13 Rural Sales Committee, Edgewater Beach Hotel, Chicago, Ill.
14-15 Sales Committee Conference, Edgewater Beach Hotel, Chicago, Ill.

APRIL

19-20 Missouri Association of Public Utilities, The Elms Hotel, Excelsior Springs, Mo.
26-28 Electrochemical Society, Asheville, N. C.

MAY

1-4 Chamber of Commerce of the United States of America, Washington, D. C.
14-18 National Fire Protection Association, Haddon Hall, Atlantic City, N. J.
24 National Board of Fire Underwriters, Waldorf-Astoria Hotel, New York, N. Y.

JUNE

4-7 Annual Convention, EDISON ELECTRIC INSTITUTE, Traymore Hotel, Atlantic City, N. J.
18-21 National Association of Purchasing Agents, Hotel Cleveland, Cleveland, Ohio.
25-29 American Institute of Electrical Engineers, The Homestead, Hot Springs, Va.

SEPTEMBER

24-28 American Transit Association, Cleveland Public Auditorium, Cleveland, Ohio.

Specifications for Lodgepole Pine and Douglas Fir Poles

The American Standards Association has recently issued specifications for two additional species of wood poles. One of these is an American Tentative Standard Specification for Lodgepole Pine Poles (O5f1-1933), and contains American Standard Dimensions (O5f2-1933) for this species—the other is an American Tentative Standard Specification for Douglas Fir Poles (O5g1-1933) and contains American Standard Dimensions (O5g2-1933) for this species of timber. Specifications for these two species of poles were prepared under the ASA Sectional Committee on Wood Poles which prepared the specifications for Western Red Cedar, Northern White Cedar, Southern Yellow Pine and Chestnut that were approved as American Tentative Standards in June, 1931.

Copies of any of the above mentioned specifications may be obtained from the American Standards Association, 29 West 39th Street, New York, at 20¢ per copy. Reduced prices may be obtained for quantities in excess of 25 copies.

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